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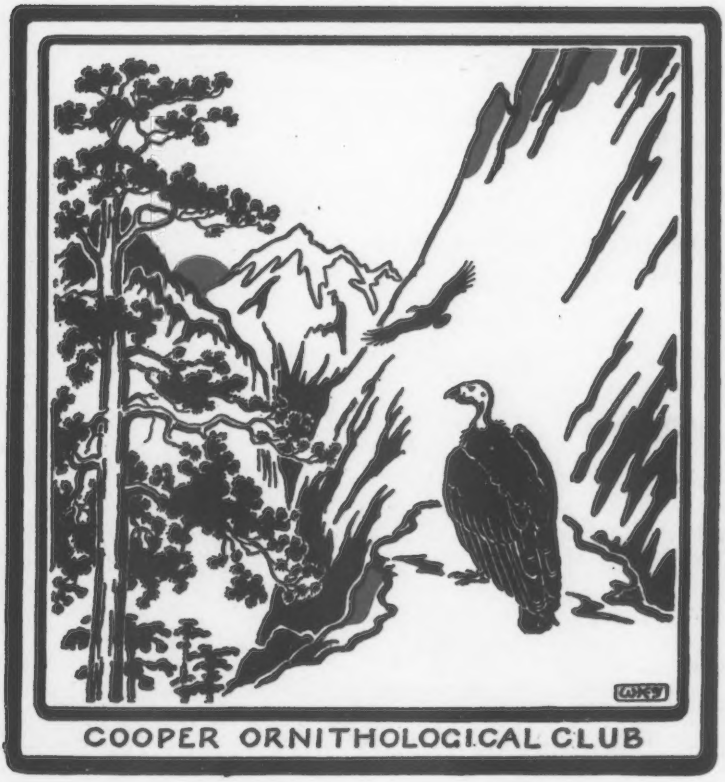

COOPER ORNITHOLOGICAL CLUB

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THE CONDOR

VOLUME 43 NOVEMBER-DECEMBER, 1941 NUMBER 6

A PERSISTENT MUTATION IN THE CALIFORNIA QUAIL

By JOHN B. PRICE and C. H. DANFORTH

The persistence for forty-five years of a recessive gene mutation in the California Quail (*Lophortyx californica*), or its repeated reappearance during that time, is a matter worthy of record. The mutation in question is a fawn or "dove-colored" variant of the normal plumage, far more striking in its divergence than any variations in plumage that separate different subspecies of quail. This mutation, which apparently is due to a single recessive factor, may appropriately be referred to as "dilute." Since the exact moment or even generation in which a gene mutation actually occurs is difficult to establish, we cannot be certain whether a newly observed trait is of recent origin, caused perhaps by experimental treatment, or results from a mutation that had occurred some time in the past and had been carried along by heterozygous individuals, only to make its first visible appearance when just the right parental combination occurred.

We first observed the dilute character in 1933 in young quail hatched in the course of some experiments on the effects of hormones and skin grafting. In March of that year (permission having been obtained from the proper authorities), a number of native California Quail were captured on the Stanford campus and confined in a large, wire-enclosed yard which offered ample opportunity for normal activity. The females laid eggs which were collected at intervals and placed in an incubator. Of 62 chicks hatched, 59 were normal and 3 were dilute. The latter had markings similar to the others but with all colors so pale or bleached in appearance as to give a general effect of uniform light yellow or "tow-color," as shown in figure 71. All three of these original dilutes died within a few days after hatching.

Fig. 71. Two normal and three dilute California Quail one day old.

In the following three years, 1934, 1935, and 1936, a few dilute young appeared each season among the normal chicks but all died before they reached maturity. As it is possible that they may have been offspring of experimental birds, we here include a condensed protocol for two of the experiments.

Experiment 1; Male 461

March 12, 1933.—Bird captured.

March 13.—Bird etherized and a few feathers plucked from several regions showing sexual difference.

March 21 to 23.—Bird kept in small inside pen and given 0.6 milligrams of thyroxin each day by mouth.

March 23.—Bird replaced in outside yard and recaptured from time to time for observation of the regenerating feathers.

Experiment 2; Male 456

Dates of capture, plucking, and treatment were the same as in Experiment 1. In place of thyroxin, 300, 200, and 100 rat-units of theelin in water were injected subcutaneously.

It does not seem likely that this treatment of the male birds could have had any relation to the production of dilute young, for in the case of a recessive mutation occurring only in the male, homozygous young would not appear until the F_2 generation the following year.

In 1937 a dilute male was raised to maturity. This bird was one of a brood of 14 young (11 normal and 3 dilute) which were captured by children on the Stanford campus who saw them falling from a palm tree on Alvarado Row where they evidently had just been hatched. These three dilutes are shown in figure 71. The parents were observed at close range as they ran about near by in anxiety; both were normal in plumage. Two of the young dilutes were lost in the process of getting them adopted by foster parents, but the third, although not vigorous, survived and assumed adult male plumage, in the dilute form, at the same time as the other males of the brood.

The following spring this dilute male was placed in a separate pen with two older females, no. 29 and no. 30, which from previous records we suspected might be heterozygous for dilute. Twenty-nine eggs were obtained from these two females before they were separated and from these were hatched 19 normal and 10 dilute young. After the females were separated, no. 30 produced one normal chick; and no. 29 produced 12 normal and 13 dilute young.

In 1939 the final test of mating two dilute individuals was attempted, but the only dilute female which had reached maturity died before any eggs were obtained. Subsequently we have not had two dilute birds of opposite sex at the same time. But it would seem evident from our observations, which are summarized in the following table, that the dilute character is due to a single recessive genetic factor.

Parents; phenotype and assumed genotype	Observed ratio		Expected ratio	
	normal	dilute	normal	dilute
1937				
Male—normal (Dd) Female—normal (Dd)	11	3	10.50	3.50
1938				
Male—dilute (dd) Female no. 30—normal (DD) Female no. 29—normal(Dd)	19	10	21.75	7.25*
Male—dilute (dd) Female no. 30—normal (DD)	1	0	1	0
Male—dilute (dd) Female no. 29—normal (Dd)	12	13	12.50	12.50

*If both females were equally prolific; actually no. 29 was more so during the rest of the season, which might really bring the expected ratio into even closer agreement with the results obtained.

When the first dilute quail was hatched in 1933, it seemed probable that the character might be a recent mutation. Later, however, a search of the quail collection in the Stanford Natural History Museum brought to light the two adult dilute specimens which are shown in figures 72 and 73.

The dilute male (S.U.N.H. no. 7123) was collected on November 10, 1896, by George Hall at San Carlos, California—about seven miles northwest of the Stanford campus. The dilute female (S.U.N.H. no. 7127) was also collected at San Carlos, on December 21, 1912, by Chase Littlejohn. Together with these dilute quail we show

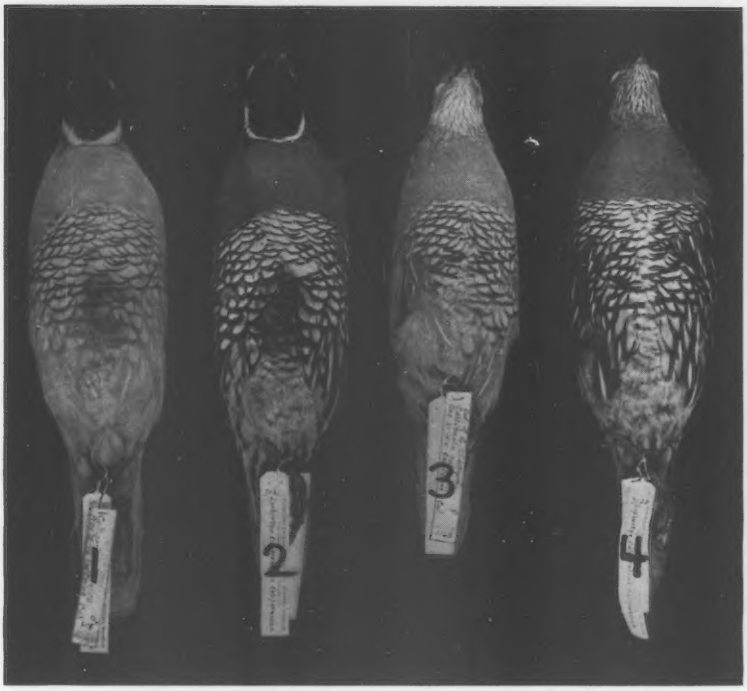

Fig. 72. Comparison of adults of dilute and normal California Quail. 1, dilute male (no. 7123 S.U.N.H.); 2, normal male; 3, dilute female (no. 7127); 4, normal female.

two normal specimens for comparison. Both were collected at Redwood City, California, by Chase Littlejohn, the male in 1907 and the female in 1895.

Since both the dilute quail were collected within seven miles of the Stanford campus where the dilute young appeared in 1933, it seems probable that for the past forty-five years at least the quail in this region have carried the recessive character for dilute, in spite of the fact that dilute adult quail are almost never encountered in the field. The probable explanation for this latter fact is that this mutation is semi-lethal in its effects. The dilute young we observed were all decidedly weaker and less vigorous than the normal young. In the wild condition the mortality is heavy among young quail in the first few days after hatching. A pair of quail will often hatch 14 or more eggs in a season, but frequently only one or two of the brood will reach maturity. Under these conditions it is probable that nearly all the dilute young perish soon after hatching. On the other hand, two-thirds of their "normal" brothers and sisters would carry the gene and thus provide for appearance of the trait from time to time when two heterozygous parents happen to mate, as in the case of the pair that nested in a palm tree on Alvarado Row.

As we have seen, the existence of this mutation among the quail of a particular locality is easy to overlook. It would be interesting to know if the dilute factor is confined

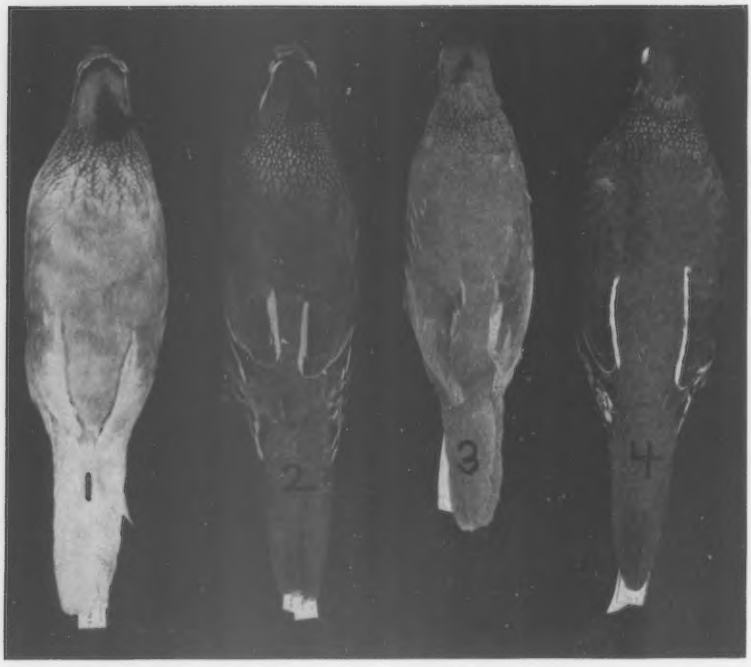

Fig. 73. Dorsal aspect of quail shown in figure 72.

to the region about Stanford, or whether it may exist among the quail in other regions of the state. Adequate information on this point would throw light on whether this is a unique or recurrent mutation and would be of special interest to those students of mathematical biology who are interested in the persistence of genes for adverse traits in wild populations.

Department of Anatomy, Stanford University, California, August 4, 1941.

A REVIEW OF CENTERS OF DIFFERENTIATION FOR BIRDS IN THE WESTERN GREAT BASIN REGION

By ALDEN H. MILLER

The expressions "center of differentiation" and "differentiation area" have found frequent application in western North America because of the restriction of many geographic races of birds and other animals to small, well circumscribed regions. The implications are that these areas have been especially potent in causing local differentiation. Recognition of a center of this kind must, it would seem, rest upon several conditions. To begin with, if it is to have any general significance, one should be able to show that several geographic races of different species and genera focus in it. If the ranges of the races are not conterminous, they must have much ground in common, and should center about a common point or show the greatest development of their racial characters there. Obviously it is not enough to judge of the existence of such centers by the grouping of type localities. The range of each race must be well known and the possible variation in degree of its characters should be ascertained. The race may in fact be only a segment of an extensive cline and thus afford no evidence of a particular "center of differentiation" either in the sense of origin or accentuation of characters.

Factors which underlie development of a center are features of the environment which will affect, indirectly, race formation in representatives of many genera. This means that these genera have something in common in their dependence on environment, which will result in parallel modifications. To find aspects of the environment sufficiently broad to produce such parallelisms, we turn usually to matters of climatic regime, zonation, and the attendant differences in vegetation. But equally important is isolation of the region, if these parallelisms are to be preserved. Also, if different generic representatives do not respond in comparable fashion to the prevailing features of the area, they are likely to show the same limits in range because of spread to common barriers. In other words the emphasis may be even more importantly upon common limitation of random differentiation than on parallel environmental induction.

For these reasons, insular or semi-insular regions of peculiar climate are those which most often take on the aspects of differentiation centers and do so most strikingly. Examples are the Cape district of Lower California, with 46 differentiates centering in it, according to Grinnell (Univ. Calif. Publ. Zool., 32, 1928:5), and the San Pedro Mártir district of northern Lower California with 28 differentiates. Other areas are Vancouver Island, the San Francisco Bay region, and the Monterey coastal district.

As soon as we deal with areas in northern and interior continental regions where isolation is weakened by poor or diverse barriers, and by migration, differentiation centers are likely to be poorly defined or nonexistent. Less coincidence in the distributional pattern of various race groups is manifest. Each species is able to exhibit its own peculiar reactions to limiting factors ; there is no common mold.

The specific purpose of the present review is to examine two supposed areas of differentiation in the light of these principles governing the constitution and significance of such centers. The two are the Warner Valley area of southern Oregon, near the junction of California, Nevada and Oregon, and the White Mountains on the central California-Nevada boundary southeast of Mono Lake. The idea that these are differentiation centers was voiced principally in the introduction of Oberholser's paper on the Warner region (Sci. Publ. Cleveland Mus. Nat. Hist., 4, 1932:1), as follows: "One of

the significant developments of ornithology in western North America has been the discovery and exposition of the centers of subspecific differentiation. Such centers are represented by the Victoria Mountains of southern Lower California, the San Pedro Mártir Mountains . . . , the White Mountains, . . . , the Charleston Mountains of southwestern Nevada. . . . A recent ornithological investigation of the region including the Warner Valley and Warner Mountains of central southern Oregon has shown that this is another such area, and one of unusual importance. . . . The birds described in the following pages [18] have in most cases their center of distribution in this area, and although some of them have a rather wide range in the western United States, and one occurs only on the Pacific slope, most of them are either confined to the Warner Valley or Warner Mountains or have a somewhat limited distribution north and south of this region." The only specific statement concerning the White Mountains as a center appears to be that of Grinnell's (Auk, 45, 1928:213): "This eastern portion [lat. 35° to Lake Tahoe, east of Sierra] of California includes what I have termed the Inyo subfaunal district, characterized by not a few peculiar races of birds [10 named up to 1941] which have been described from the White, Inyo, Panamint, or others of the numerous mountain ranges of that territory, or from the adjacent or intervening valleys. Resident birds of plastic groups many of them show well-marked characters of pale coloration and large size, as compared with related forms to the west or south." It will be noted that there is no intent to limit this area to the White Mountains, although such limitation seems implied in Oberholser's listing of areas quoted above.

The Warner Valley area was visited by me in 1937 in company of a party from the Museum of Vertebrate Zoology with a view to gaining acquaintance with this differentiation center and of obtaining topotypes of races described from there. In both of these quests we were reasonably successful. One is immediately impressed with the diversity of the area from the standpoint of avian habitats. The Warner Mountains present belts of coniferous timber along a more or less isolated uplift which extends into California. The piñon-juniper association of the lower levels is continuous with like areas in the regions to the east and south in the Oregon and Nevada deserts and on the Modoc-Lassen plateaus. The valley itself, with sagebrush lands, streamside thickets, and meadows, is a fairly deep basin delimited sharply at least on the west. It appears definitely to be the westernmost of a series of desert valleys which are typical of the northern Great Basin region. The brushlands of it are widely continuous with like country to the east. From this brief characterization it should be apparent that the problem of differentiates in these three main divisions of the area are likely to be different. The montane section is isolated, but in general is an outlier of the Sierra-Cascade Mountain system, whereas the valley itself represents merely the western edge of the Oregon desert. The apparent environmental causes of differentiation and the barriers in these divisions are not at all the same. We are not dealing with one possible center but a composite with several environments and with various barriers that happen to fall close together or happen partly to coincide in this section of the country.

The evidence for the Warner center lies in 17 forms described from it plus one described earlier by Swarth (Proc. Biol. Soc. Wash., 31, 1918:162) from the Warner Mountains of California. The study of these races has in effect been done to test out Swarth's (Condor, 35, 1933:44-45) critical comments made of the wholesale and sketchy descriptions of forms from that area. So far as possible the limits of each recognizable race have been traced and variations within the race looked for. With the large number of genera involved, the treatment of each form could not be exhaustively revisionary, but certainly some progress has been made toward a better under-

standing of the differentiates of the region. Grateful acknowledgment is made of assistance given by Harvey I. Fisher and Joe T. Marshall, Jr., in assembling data for this study.

Of the 18 forms, 6 are thought to be without basis in fact. In general, no geographic variation can be detected in our material for these forms; all variation appears to be merely individual and seasonal. A synopsis of our findings concerning these proposed races follows:

Lophortyx californica orecta. California Quail. Van Rossem (Auk, 56, 1939:69) examined 11 specimens (8 males) in fresh fall plumage from Adel, 9 miles north of the type locality, and found that the color difference in comparison with *L. c. californica* reversed that claimed by Oberholser, concluding that they were not distinguishable from the latter. His size comparison, giving extremes, likewise failed to reveal tangible difference. Oberholser had fresh fall material, 12 males and 4 females, mentioned as adults. Our series of 6 males and 1 female, taken in the early breeding season at the type locality show no color difference compared with *L. c. californica*, nor do birds from the Warner Mountain region in California. Perhaps a larger proportion might be classed as paler and less olivaceous. Size differences are not apparent in our comparison any more than in van Rossem's. Conclusion: the race is unrecognizable; the situation is perhaps complicated locally by introductions, since these are known to have been made in Surprise Valley in Modoc County, California.

Empidonax traill adastus. Traill Flycatcher. The only character claimed for this race, the color of the upper parts, I find exceedingly variable individually. Oberholser states that the color is more greenish brown (less yellowish or rufescent). A near-topotypical series of 11 June-taken birds, 12 birds from the Blue Mountains to the north, and a good representation from Nevada, the Sacramento Valley of California and western Oregon have been compared. In each I find greenish brown, bright green, and dull gray-green birds which do not separate sharply into phase categories. These different types are of about the same abundance in each area. Certainly the pale grayish green birds present in the Warner series are duplicated in breeding birds west of the Sierra with fair regularity. Conclusion: race not recognizable and no clear cut trends indicated; the range originally ascribed is suspiciously "unnatural."

Stelgidopteryx ruficollis aphractus. Rough-winged Swallow. We have a topotypical series of this supposed race consisting of 12 individuals, and in addition large numbers from some of the western states included in the range ascribed to *aphractus*. Although only a small number of eastern birds has been compared, no suggestion of the color differences and the small size attributed to them can be made out. Even in the few eastern birds at our disposal most of the range in wing length of the topotypical series of *aphractus* is represented. Admittedly the comparison in this species has not been pursued as far as could be wished. But on the grounds that we are quite unable to sort out individuals of the supposed races on the characters ascribed, we must conclude that no useful purpose is served in recognizing *aphractus*. I am even doubtful that a trend in geographic differentiation exists.

Euphagus cyanocephalus aliastus.Brewer Blackbird. Eleven males and 12 females from the Warner Mountains, many of them topotypes, have been used in comparison with Rocky Mountain material (5 males and 4 females) considered representative of *E. c. cyanocephalus*. Females from the Warner region usually are darker above and below than the Rocky Mountain examples, that is, are less brownish, but some are indistinguishable. Much of this variation is dependent on wear of the brown tippings of the feathers, which fluctuates even in specimens of the same dates taken in May and June. Large series of fall specimens from both regions would be necessary to eliminate fully the possibility of difference in color in females. The variations in the type of metallic green of the breasts of males, whether yellowish or greenish, in our series follow no geographic lines.

Oberholseria chlorura zapolia. Green-tailed Towhee. Twenty-seven males and 8 females from the Warner Mountains were compared with 9 males and 10 females from the Rocky Mountains from whence the type of *chlorura* was taken (Blackfoot, Idaho). Oberholser characterized *zapolia* as more grayish (less greenish, brownish or rufescent) above; flanks more grayish (less buffy), and anterior lower surface more clearly gray. The race is supposed to range along the Sierran-Cascade Mountain system and into northeastern Nevada. All the color differences cited are likely to be confused by wear, as Oberholser of course realized. Neverthless it seems possible that not enough heed was given to this factor. We can arrange our spring-taken material in a chronologic scale and find that it then makes a roughly graded series ranging from brown to gray. Also, two June-taken females from Iron County, Utah, in the range of the supposed brown race, are the grayest of all our spring and early summer material. A survey of possible size differences has shown nothing of positive nature. Conclusion: no decisive evidence of a geographic grouping of characters can be found; race invalid.

Chondestes grammacus actitus. Lark Sparrow. The characters claimed for this race are paler

upper parts (except head stripes) and somewhat longer wing, these in comparison with *strigatus* of "Mexico and southern Arizona." Here again we have not been able to see duplicated in our topotypical (10) and near topotypical material the color differences claimed. Oberholser makes no reference to California material and it is not clear whether he considers such to pertain to *strigatus* or *actitus*. Our topotypes of *actitus* differ not at all from series from southern California and from Humboldt County, Nevada, nor from birds in comparable stages of wear from southern Arizona and New Mexico. Larger representations from these latter regions and Mexico would be desirable, but there seems to be no doubt that the Warner Valley birds are like those from other parts of the Pacific coast and Great Basin regions. In wing length, *actitus* averages (males) slightly smaller than sample series from Arizona and New Mexico, northeastern Nevada, the Coachella Valley of California, and Modoc County, California; it is slightly larger than a group from San Diego County. All these differences are unreliable statistically but the trend they show is, if anything, the reverse of that claimed. Conclusion: race probably invalid and certainly not as yet properly demonstrated.

We now turn to a group of 6 proposed races that signify observable geographic trends but which because they are too weakly differentiated or because they are parts of intergrading complexes seem unworthy of recognition.

Phalaenoptilus nuttallii nyctophilus. Poor-will. The 7 birds from the south end of the Warner Valley in our collection suggest as a group an approach to *californicus*, yet they can be perfectly matched by individuals of *nuttallii* from Utah, Wyoming, Idaho and Nevada. In measurements of wing length and in amount of white on the rectrices, the averages of the Warner birds coincide with those for *P. n. nuttallii*; there is broad overlapping of the races in these features. The proportion of birds with dark dorsal ground color and large dark spots on the scapulars is greater than in *nuttallii* and less than in *californicus*. Otherwise the coloration closely resembles that of *nuttallii*. The type locality of *nyctophilus* is north and east of the place where our series was taken, but this can scarcely be viewed as important. One bird that we have from Alkali Lake, north of the type locality, is typical *nuttallii*. It is concluded that *nyctophilus* does not differ importantly from *P. n. nuttallii* and such departure as it does show indicates intergradation toward western populations.

Tyrannus tyrannus hespericola. Kingbird. This race was found difficult to recognize by Zimmer (Am. Mus. Nov. No. 962, 1937:12), who says: "In general, western birds are slightly larger than eastern ones and may be slightly paler than eastern ones, but the overlap appears to be too large to warrant separation." Wetmore (Proc. U. S. Nat. Mus., 86, 1939:199) comments that this race "is marked mainly by slightly grayer dorsal coloration, the alleged difference of larger size holding only for part of the individuals examined. The white band on the tip of the tail averages slightly wider in the western race but is subject to considerable abrasion, so that in numerous specimens from the west no difference is to be noted." Wetmore concludes that the race should be recognized, although he grants that the difference between the two races is slight.

In an effort to lay out the facts supporting the contention of racial distinctness of *hespericola*, I have examined the following birds with respect to wing, tail and tarsal dimensions, extent of the white tip of the tail, back color, and breast color: Western group: Camrose, Alberta, 1; Hazelton, B. C., 2; Powder River County, Montana, 1; Rosebud County, Montana, 10; Missoula County, Montana, 4; Bonner County, Idaho, 1; Washington County, Idaho, 2; Adams County, Idaho, 1; Fremont County, Idaho, 1; Benton County, Washington, 2; Crook County, Oregon, 3; Lake County, Oregon (near topotypes), 3; Humboldt County, Nevada, 2; Los Angeles County, California (migrant), 1; total, 34. Eastern group, east of latitude 100°: 18.

The dimensions in millimeters (averages and extremes) are as follows:

	No.	Wing	Tail	Tarsus
Eastern males	13	116.3 (112.8–122.2)	83.1 (80.3–85.4)	18.8 (17.7–20.0)
Western males	18	116.9 (110.8–121.4)	82.1 (77.8–88.1)	18.6 (17.8–19.5)
Eastern females	5	116.9 (110.4–120.0)	80.4 (77.2–85.3)	18.7 (18.0–19.2)
Western females	16	112.8 (109.2–116.6)	81.0 (76.5–85.2)	18.9 (17.6–20.1)

These figures alone, even without special statistical treatment, show that there are no significant size differences. This is particularly evident in the well-represented group of males. The difference in the wings of females, in a direction the reverse of that heretofore claimed, is fairly clearly attributable to the small sample from the east. It should be cautioned that the measurements do not coincide in absolute value with those given by Oberholser, apparently because of some unknown deviations in method of measuring.

The white tip of the central tail feathers was measured only if unworn. The variability is so great as to make insignificant the small average differences. This is shown in the following table, in which

individual western birds are represented by an "o," eastern birds by an "x." Averages are: eastern males, 8.6 mm.; western males, 9.9; eastern females, 9.6; western females, 9.8.

Length of white tip of central rectrices

Mm.	6	7	8	9	10	11	12	13	14
Males	x	o	o	o	o	o		o	o
		x	o	o	o	o		o	
			o	o	o	x			
			o	o	o	x			
			x	x	x				
			x	x					
			x						
			x						
Females	o	o	x	o	o	o	o		
				o	o	x	o		
				o	o				
				x	o				
					o				
					o				

Obviously the white tail tip cannot be used as a means of identification, even though the eastern population may lack the extremely white variants of the western group. Neither in this character nor in others have local differences within the western group been detected.

In back color, some difference is apparent, as also in the degree of darkening on the breast, the eastern birds being darker in both respects. As has been remarked, however, these differences are slight and there is much overlapping. Birds from both geographic regions were mixed and sorted according to color. Using the back, only 60 per cent success was had in segregating them into the correct geographic groups. With the breast, barely 70 per cent success was had and this could not be improved upon by using breast and back in combination.

In conclusion it is recommended that the race not be recognized because it is not possible to identify a large enough percentage of individuals. This is a practical consideration. The fact is interesting nonetheless that there is a weak differentiation, not sharply defined structurally or geographically, which follows a pattern familiar in many other bird species. However, the differentiation does not center in the Warner Valley, which is at the western margin of the range of the species.

Petrochelidon albifrons aprophata. Cliff Swallow. Van Rossem (Pac. Coast Avif. No. 24, 1936:33) in discussing *P. a. hypopolia*, and *P. a. aprophata* states that he does "not believe it practical to acknowledge more than one large, light-colored race from the Great Basin and northwestern interior." Thus *aprophata* is considered a synonym of *hypopolia*, and this is probably correct. More needs to be known of the relation of Great Basin birds and those of the Mackenzie region. Leaving this question aside, the birds of the Great Basin are, in wing length at least, consistently different from the birds of the Pacific coast (*P. a. albifrons*) and are reasonably uniform among themselves. Along the east side of the Sierra, cliff swallows show larger size, some groups as in Mono County (van Rossem, *loc. cit.*) being fairly representative of *hypopolia*, others, as in the Tahoe district, being intermediate. Our series of topotypes of *aprophata* from the Warner Valley are similarly intermediate, most of the individuals falling in the size-range of *P. a. albifrons*. Only 4 out of 13 fall well into the size range of *hypopolia*. For this species, the Warner Valley is an area of intergradation, as might be expected from its position at the western margin of typical Great Basin country.

Cyanocitta stelleri syncolla. Steller Jay. Stevenson (Condor, 36, 1934:75-76) gave extended attention to this form in a review of jays of this species. The material he had was much more adequate than Oberholser's and he examined the type series. Since then fifteen topotypes or near topotypes have been acquired. Review of the material reveals no evidence at variance with Stevenson's exposition of the facts. In brief, the Steller Jays of the Warner Mountains represent in coloration a part of the trend northward in *frontalis* toward the darker *paralia* of coastal Oregon. They are a large-sized extreme of *frontalis*, suggesting a trend toward the large *annectens* of eastern Oregon. This size difference, though real, does not permit sufficient segregation of individuals to make advisable the recognition of the race. As regards the Warner differentiation center, it is not certain that the differences in the jays afford contributory evidence; they may be thought of as part of a discontinuous cline, running northeastward, the character of which is in some measure shaped by the isolation and geographic position of the Warner Mountains.

Hylocichla guttata oromela. Hermit Thrush. McCabe and McCabe (Condor, 35, 1933:122-123) have brought to notice the confusing situation concerning the type of *oromela* and the application of the name. The birds to which the name apparently was intended to apply are those of the Cascade Mountains, which although slightly larger than *slevini* and occasionally of darker dorsal coloration, are not sufficiently different to warrant recognition as a separate race. The Cascade birds and those of the Siskiyou Mountains form a gradient in color and size leading north toward *H. g. guttata* of British Columbia. Those of Oregon at least are much closer to *slevini* in average coloration. The large-sized *sequoiensis* has already been modified in the Lassen Peak area, and the birds of northeastern California are not typical of either *sequoiensis* or *slevini*. They may be viewed as *slevini* grading in the direction of the distinctly large *polionota* to the eastward or as *sequoiensis* diminished in size northward toward *slevini*. Full treatment of this complex of size groups will not be detailed here. It is sufficient to indicate that the Warner Mountain birds form a group lying between three size races and as such they display the expected intermediacy. Birds on the east flank of the Cascades in central Oregon show evidence of mixture with *polionota* to the eastward through the presence of occasional unusually large individuals. Whether the type of *oromela* was a bird representative of the Warner Mountains intermediates or a migrant from the northern part of the range of *slevini* can not be determined without full study of the type, especially its measurements, which have not been reported upon.

Pooecetes gramineus definitus. Vesper Sparrow. The principal character claimed for this race in contrast to *confinis* described from the Great Plains is less white in the tail. The best quantitative expression of this is gained through the following measurements:

Length of white area on inner web of outer rectrix in males

No.	Group	Average and extremes
9	Alberta, Wyoming, Colorado	40.4 (34.0–43.3) mm.
	Oberholser's figures for *P. g. confinis*	40.9 (33. –61.5)
10	Oberholser's figures for *P. g. definitus*	32.5 (26.5–42.5)
5	Topotypes of *definitus* in Mus. Vert. Zool.	39.3 (32.9–46.4)
16	Northwest Nevada; Modoc-Lassen region, California	34.8 (29.5–44.0)
9	Mono Lake, California	35.4 (31.2–41.0)
11	Death Valley; Owens Valley (spring migrants in part)	40.3 (34.7–45.0)

The dangers involved in reliance on small samples are here apparent. The original type series of *definitus* is seen to be distinctly different from five measurable topotypes taken by our party. Without presenting here the complete picture of the variance in this measurement, it may be stated that there is complete overlap of the two geographic groups, namely, Great Basin and Rocky Mountain-Great Plains. It will be noted that the individuals with absolute maximum and minimum of white both came from the type locality of *definitus*. Disregarding the group from the Death Valley-Owens Valley region which was partly composed of migrants, there is a lesser average in white in the Great Basin groups; but considering the magnitude of individual variation in each sample, these average differences are small and of uncertain validity. With larger samples one might establish statistically a slight difference of this sort, but the difference is not useful as a basis for nomenclature. The absence of white on the inner web of the next to outermost rectrix was not found to be invariable in Great Basin birds.

The recognizable races of the Warner region total six. Two of these are wide-ranging, namely the White-crowned Sparrow and the Warbling Vireo.

Zonotrichia leucophrys oriantha. White-crowned Sparrow. This race is apparently well marked in contrast to birds of the eastern part of the continent, showing the characters as given by the describer. We have not seen as much eastern material as is desired, but there seem to be good grounds for recognizing the race if all eastern material is as dark-colored as the specimens we have at hand. Close comparison of groups of breeding birds from the Cascades, Sierra Nevada, and Wallowa Mountains, Oregon, and Rocky Mountains of Wyoming and Utah, shows no differences between western populations. There are no peculiar features displayed in the Warner group, nor is there accentuation of characters here.

Vireo gilvus leucopolius. Warbling Vireo. This race shows considerable overlapping with *swainsonii* in color of the back, the main feature that distinguishes it. Even though the geographic boundaries are not too sharply defined, the race seems worthy of recognition. Sibley (Condor, 42, 1940:255-258, fig. 76) in a recent study of this group makes the following statements about this race, in which I concur: "In the collection of the Museum of Vertebrate Zoology are 125 specimens, including 12 topotypes referable to this race. The characters agree with the original description but the form has a much greater range than Oberholser . . . gave. He stated that it was, 'confined . . . in the Warner Valley

and to a narrow area north and south of this region . . . .' Its range may be better characterized as the Great Basin. Examples of *leucopolius* have been examined from northeastern California, eastern Oregon and Washington, southern Idaho, western Wyoming, western Utah and practically all sections of Nevada. The range as now delimited lies between the Cascade-Sierran system on the west and the

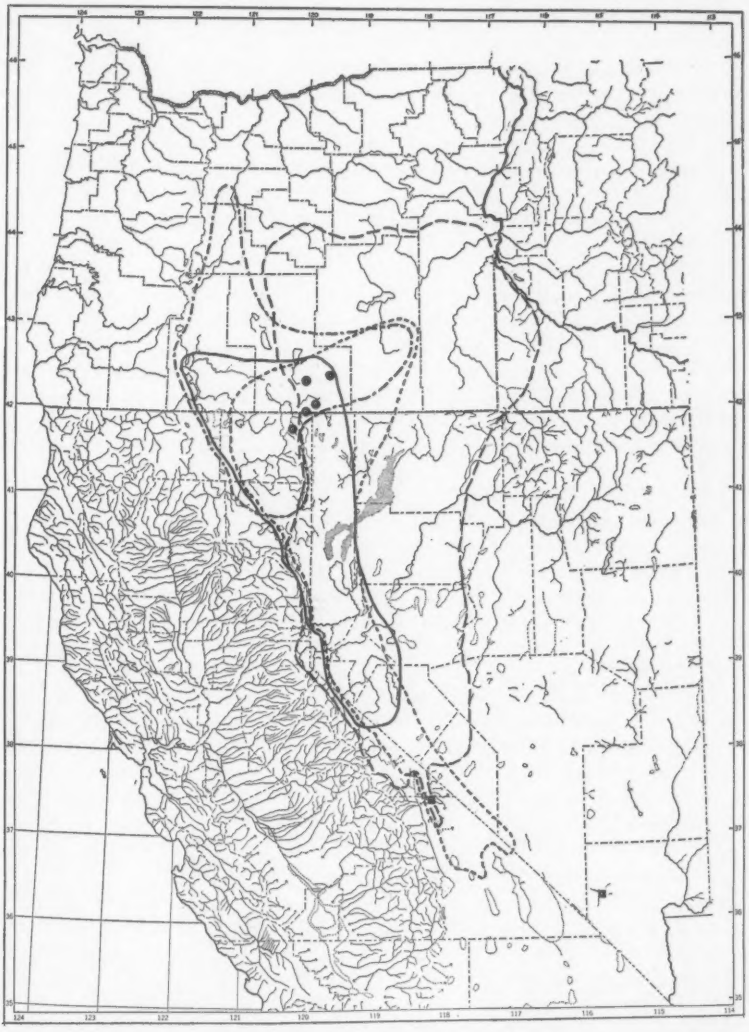

Fig. 74. Map of Oregon, California, and Nevada, showing distribution of four of the races of birds described from the Warner area. Dots represent all type localities in this area. Squares mark the White Mountains and the Charleston Mountains. Solid line outlines range of *Thryomanes bewickii atrestus*; long dash, *Otocoris alpestris lamprochroma*; dash and dot, *Passerella iliaca fulva*; short dash, *Baeolophus inornatus zaleptus*.

eastern slope of the Rocky Mountains to the east. It extends from southern Idaho to southern Nevada." As with the White-crowned Sparrow, the Warner Mountains are of no more significance than other points in the Great Basin in the biology of this race.

Four races are of more restricted distribution and these have been mapped (fig. 74). The outlines of range do not mean that each form is of continuous distribution within the area shown. The lines are drawn on the basis of the best information available, and on surmise. Although I disapprove of the inaccuracies inherent in such a plan of representation, it seemed necessary to resort to this kind of aid in visualizing the relation of the races to the Warner region.

The Horned Lark (*Otocoris alpestris lamprochroma*) has been studied in detail by Behle who has an extensive report in press on this group. Behle remarks that the most typical specimens of the race occur in that part of the range extending from the Warner Valley to Mono Lake, California. Note that the range includes the White Mountains of California.

The Plain Titmouse (*Baeolophus inornatus zaleptus*) has been recognized by Linsdale (Condor, 40, 1938:37-38) and the characterization of it reviewed and corrected. The apparent extension of this form south into the Inyo region has been discussed by Grinnell and Behle (Condor, 39, 1937:226).

The Bewick Wren (*Thyromanes bewickii atrestus*), a well-marked race, has recently been shown (Miller, Condor, 43, 1941:251) to be more wide-ranging than originally described. Even so it is the most restricted in distribution of any of the valid forms described from the Warner region; it extends south only to Lyon County, in west-central Nevada.

The Fox Sparrow (*Passerella iliaca fulva*), described by Swarth, is a well-known race with range extending to the north of the Warner Mountains but with the best development of characters in the Warner area. The distribution here shown is modified from that given by Swarth on the basis of later reports and state lists.

To summarize, the four races of more or less restricted range include two that extend south to the supposed White Mountains center (Horned Lark and Titmouse). The other two (Fox Sparrow and Bewick Wren) do not impress one as centering geographically in the Warner region. In fact they merely overlap here. In only two (Horned Lark and Fox Sparrow) is there indication that characters are extreme in the Warner region, although not exclusively here in the case of the Horned Lark.

We may conclude that the Warner area is not a true center of racial differentiation. There is not one true endemic form. There are several races typical of the Great Basin or of the northwestern section of the Great Basin or of the east slope of the Sierran uplift that have been named from here. In like fashion some valid Great Basin forms (races of *Agelaius, Molothrus, Pipilo, Passerculus* and *Melospiza*) have been described from the Pine Forest Mountains of northwestern Nevada.

As an afterthought, we wonder what the score for the Warner area would be if all proposed forms were recognizable. Perhaps I am unable to detect differences that exist because of inadequate material or faulty perception. If this were the case, we find nevertheless that only 7 of the 18 forms were thought originally to be limited chiefly to this area, judging from the statements about range given for each form. Two of these (races of *Petrochelidon, Cyanocitta*) we now view as intergrades, recognizing that there are differences. Three are adequately marked races but are now shown to be of more extensive range (*Baeolophus, Thryomanes*) or of very wide range (*Zonotrichia*). The other two (*Lophortyx* and *Chondestes*) we might for argument concede are valid, and still the evidence would be poor indeed for a center of differentiation.

The Inyo area, like the Warner area, is characterized by a diversity of terrain and habitat. The several mountain ranges are isolated from the Sierran mass on the west and from scattered high ranges in southern and central Nevada, with which they are nevertheless related faunally. The lower desert sinks of the Inyo region resemble in part the Mohave Desert, but also the Great Basin region.

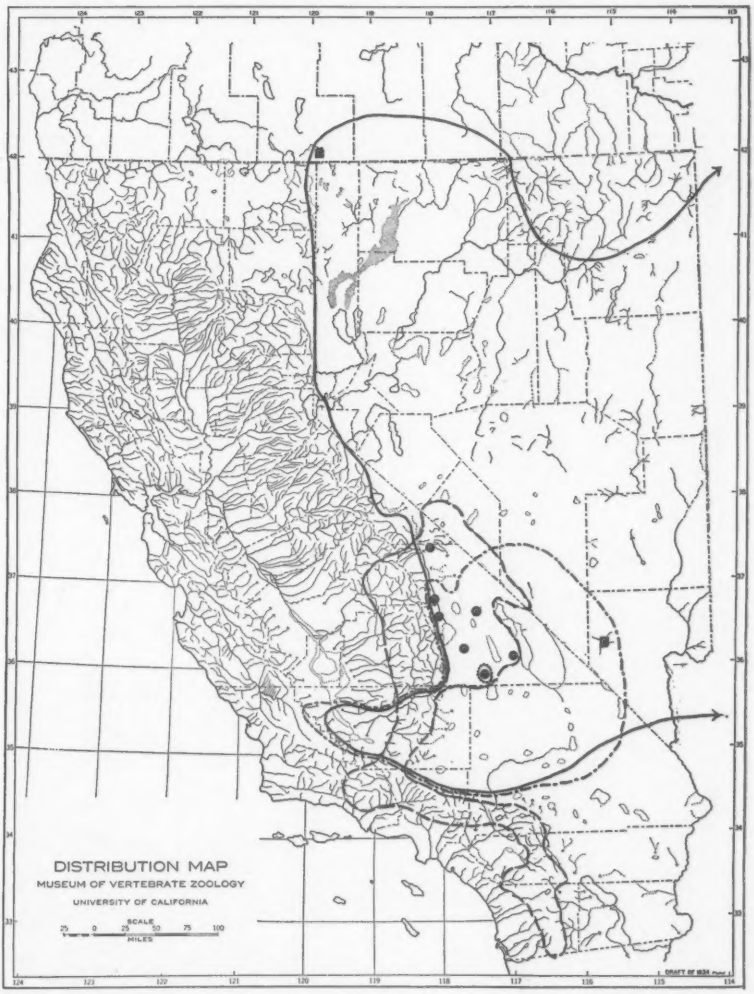

Fig. 75. Map showing ranges of four of the races of birds described from the Inyo area. Dots represent all type localities in this area. Squares mark the Warner area and the Charleston Mountains. Solid line, *Lanius ludovicianus nevadensis*; long dash, *Oreortyx picta eremophila*; dash and dot, *Otocoris alpestris ammophila*; dots, *Pipilo fuscus eremophilus*.

Ten races of birds have been named on the basis of type material from the Inyo section. Five races relate to the montane regions, five to lower levels. In surveying the distribution of these, less critical attention has been given to their characters than to those of the birds of the Warner area because most of them are forms of long standing recognition or they have been treated in detailed revisionary studies in late years. Least known are the races of California Quail and Screech Owl.

Lophortyx californicus canfieldae. California Quail. This race, described by van Rossem (Auk, 56, 1939:68), has not been studied by me because of lack of material. Its range is probably not yet fully known and therefore it is not mapped. Van Rossem ascribes it to Owens Valley.

Otus asio inyoensis. Screech Owl. Originally this race was known only from Owens Valley. Since then material from Fallon, Churchill County, Nevada, has been shown to belong to this form (Hall, Condor, 40, 1938:259). Oberholser (Jour. Washington Acad. Sci., 27, 1937:356) has even referred specimens from northern Utah to this race. The occurrences are thus too few and too greatly scattered to plot the range, but enough is known to show that the form ranges beyond the Inyo region and probably over a large sector of the Great Basin.

In figure 75 are shown the ranges of *Lanius ludovicianus nevadensis, Otocoris alpestris ammophila, Pipilo fuscus eremophilus* and *Oreortyx picta eremophila*.

The shrike (*L. l. nevadensis*) is a Great Basin form, the western part of its range here shown being essentially as mapped at an earlier date by me (Univ. Calif. Publ. Zool., 38, 1931:75). The Horned Lark (*O. a. ammophila*), based on Behle's work in press, is a race that occupies both the Mohave Desert and Inyo regions and in the southwest coincides with the range of the shrike. The Brown Towhee (*P. f. eremophilus*) is a narrowly restricted endemic found in the middle levels of the Argus Mountains (van Rossem, Trans. San Diego Soc. Nat. Hist., 8, 1935:69-72), its closest relatives occurring to the west in the Kern River basin. The race of the Mountain Quail (*O. p. eremophila*), a bird of the mountains but not of the highest levels, is inseparable from populations in the southern Sierra Nevada and the mountains of southern California (van Rossem, Condor, 39, 1937:21).

Three of the other four montane races (Hermit Thrush, *Hylocichla guttata polionota*; Mountain Chickadee, *Penthestes gambeli inyoensis*; and White-breasted Nuthatch, *Sitta carolinensis tenuissima*) correspond in the southern, eastern and western limits of their ranges (fig. 76), occupying the southern Great Basin mountain ranges, but they vary in their northward extension, the Hermit Thrush extending north through the Great Basin to southeastern Washington and central Idaho. The Fox Sparrow (*Passerella iliaca canescens*) has a restricted distribution eastward across central Nevada, replacing in this section the race *schistacea* of the northern Great Basin. Viewed in a different way, the five montane forms are either widely spread in the Great Basin (2), are limited to the southern Great Basin (2), or are limited to western mountain systems, spilling over into the edge of the Great Basin (1). Three of the montane forms occur also on the Charleston Mountains which have been viewed, with good reason, as themselves constituting a differentiation center. (The Charleston and Sheep mountains, of more southerly location, are well isolated and possess at least three endemic birds; but in comparison with the San Pedro Mártir Mountains, they are of small significance.)

With respect to the White Mountains, we may conclude that this range is not in itself a differentiation center for birds. The Inyo area in which it is included may be so regarded, with somewhat more evidence to support this view than there was in support of the Warner area. However, more correctly, the Inyo sector should be viewed as representative of either the southern or southwestern Great Basin, to which larger areas

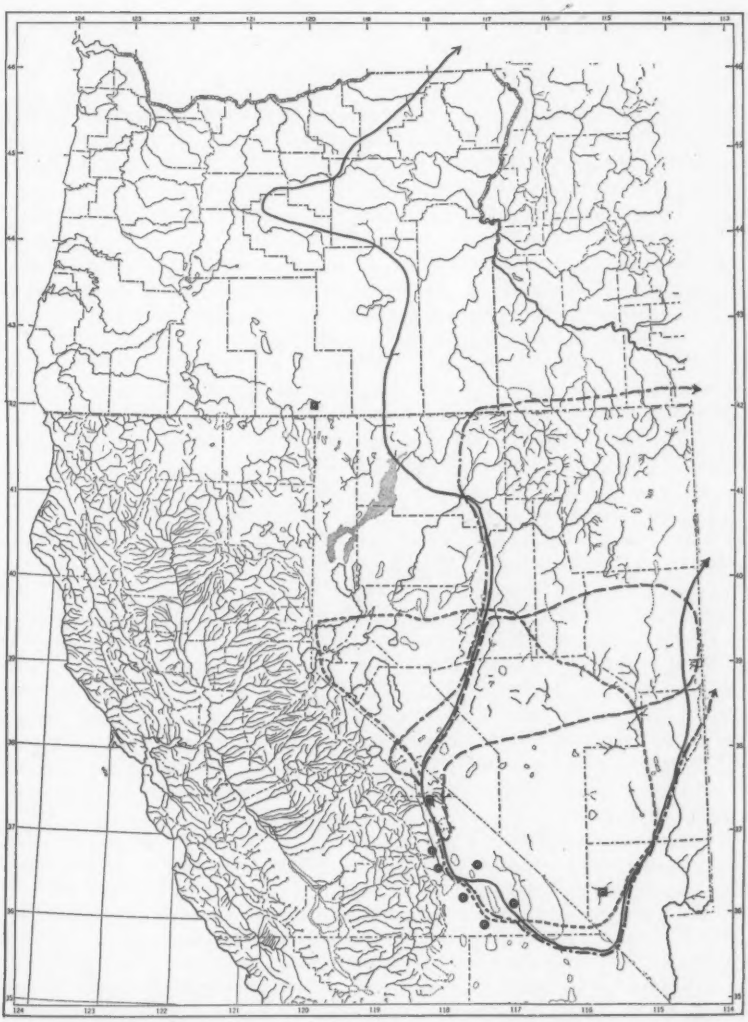

Fig. 76. Map showing distribution of four additional races described from the Inyo area. Solid line, *Hylocichla guttata polionota*; long dash, *Passerella iliaca canescens*; dash and dot, *Penthestes gambeli inyoensis*; short dash, *Sitta carolinensis tenuissima*.

several races are confined. These races are not more extremely developed in the Inyo sector than elsewhere. Their boundaries are most likely to coincide closely here because of the sharp westward limitation of habitats along the east side of the Sierra Nevada.

Museum of Vertebrate Zoology, Berkeley, California, August 25, 1941.

ABERRANT MATING ACTIVITIES OF THE CALIFORNIA WOODPECKER

By LOWELL ADAMS

At 4:55 p.m. on May 11, 1941, while driving on State Highway 168 about two miles southwest of Tollhouse, Fresno County, California, I noticed three California Woodpeckers (*Balanosphyra formicivora*) on the oiled pavement. These birds attracted my attention particularly because they failed to fly away as I passed about ten feet from them. I stopped about 150 feet from the birds and observed the following activities through 8-power binoculars.

One woodpecker, a female, was lying on her belly two feet from the edge of the pavement, just outside the course usually followed by the wheels of passing automobiles. This bird seemed to be injured. She occasionally lifted her head and opened her eyes but the head and eyelids soon drooped so that she again lay prone on the ground with eyes closed. Two other birds stood upright on the pavement beside the female. A third bird, soon joined by a fourth, was perched on a fence post about ten feet away, looking out across the top of the post in the "bartender" fashion characteristic of these birds. The last four birds were probably all males; at least two of them, which I later observed at closer range, were males.

Shortly after the binoculars were focused on them, one of the males hopped on top of the female, placing its feet in the middle of her back. Then he pecked several times in a rather gentle fashion at the base of her skull. The second male then hopped on the back of the first male while the latter was still on the female's back. This three-decker stance was maintained for about five seconds; then both males flew away. They returned almost immediately and repeated the performance. The second time one jumped on the female's back it seemed to attempt to copulate with her, appressing his vibrating tail feathers and cloacal parts down against the tail feathers of the female. Later a male tried to reach the prostrate bird's cloaca by turning partly over to one side and inserting its tail between the pavement and the female's tail. The pecking at the female's nape, described above, may have been an attempt to overbalance her forward so that her tail would be raised in a balancing maneuver, thus permitting easier access to her cloaca. Once as copulation was attempted it appeared to be successful, but I was not sure about this.

For thirty-one minutes the males continued to hop on and off the female. Sometimes they tried to copulate and at other times they merely stood. Whenever one moved to hop on, others seemed stimulated to do likewise. Those on the fence posts flew down and joined the activities. After about twenty minutes two birds flew away and did not return. The two that remained occasionally stood beside the female and looked about, then one or the other or both would hop onto her back again. Automobiles passing frequently about 10 feet from the birds usually failed to frighten them away. Automobiles traveling in the opposite direction usually drove within a foot or two of the female. The males always flew away when this happened and once the female exerted herself but succeeded only in turning her body about 180 degrees. Finally I went closer, to within 50 feet of the birds, and was then able to observe that the two active birds were males and the one lying on the pavement was a female. Also, more detailed analysis of the copulatory activities was possible at this close range.

At 5:26 p.m. I approached and picked up the female. She made no attempt to elude me. Lying under her was a freshly broken woodpecker egg, the shell of which was leathery and only partly calcified.

I took the female to the car. She showed no external indications of having been injured. She seemed to be extremely lethargic but was able to cling feebly to my hand with her feet. Then gradually she seemed to revive. After about ten minutes she showed signs of fear and made feeble attempts to escape by fluttering to the floor of the car and crawling under the seat. I retrieved her and held her while my wife drove. After driving about three miles we stopped and as the car door was opened, the bird flew to the ground. Then she flew rather awkwardly in a wide arc about 100 feet in radius. Finally she flopped into some tall grass with her wings outspread, and I picked her up.

The rest of the way home she rode in the glove compartment which was left ajar to admit air. We arrived home at 7:30 p.m. At that time the bird seemed almost fully recovered. She was placed in a small wire-mesh box trap which had been made for trapping ground squirrels. A few days later a larger cage in which she could fly about was constructed for her. The next morning after her capture she ate some acorns which were placed in the trap. Other acorns she poked through the wire mesh and among some rags in the bottom of the cage, apparently in an attempt to cache them. At 11 a.m. that day I put a jar of water in the trap and the bird immediately drank several mouthfuls as if she were extremely thirsty. The woodpecker appeared to be entirely normal again.

At the present writing, May 24, 1941, thirteen days after she was captured, she is still alive and apparently in good physical condition. She has eaten acorns, suet, piñon pine nuts, digger pine nuts, and almonds during her period of captivity. A log about six inches in diameter and four feet long was placed in her cage and she has pecked away about four cubic inches of wood from a partly decomposed area at one end. Once while she was engaged in pecking at the log I saw her stop and swallow something that looked like a grub. Twice I have seen her asleep and both times she had her head tucked out of sight, apparently under her scapulars. On one occasion she was perched on a vertical wooden surface inside the nest box. The other time she was perched on an inclined surface of the log.

In response to a letter of inquiry, Dr. William E. Ritter of the University of California replied that he considered the mating activities described above as coming "under the general head of maladaptive activities." Dr. Ritter discusses the social and phylogenetic significance of such activities in his book, "The California Woodpecker and I" (Univ. Calif. Press, Berkeley, 1938).

Fish and Wildlife Service, Sanger, California, May 24, 1941.

NOTES ON THE FOOD OF THE CALIFORNIA CLAPPER RAIL

By JAMES MOFFITT

Comparatively little has been published upon the food habits of the California Clapper Rail (*Rallus obsoletus obsoletus*). Grinnell, Bryant and Storer (Game Birds of California, 1918:288) devoted but one short paragraph to a summation of the information then available. Laidlaw Williams (Condor, 31, 1929:52-56) contributed an important paper on the subject.

Because this is a "threatened species" which has been greatly reduced in numbers for various reasons in the past 50 years, knowledge of its natural history is especially desirable. The "spotty" distribution of this rail, its abundance in some localities and absence from others seemingly as suitable, suggests that ecological differences fundamental to rails exist in marshes of similar external appearance. For instance, clapper rails are extremely abundant in the unreclaimed parts of south San Francisco Bay, where tide-flooded salicornia marsh provides the preferred habitat. Yet similar marshes in the northern part of the Bay and at the south end of Tomales Bay, Marin County, support but a small population of rails. The species is apparently unknown from Suisun Bay and the entire delta area above Carquinez Strait, where extensive salicornia marshes also exist. This region is one of reduced salinity, with quite fresh water seasonally in the spring, which may possibly affect rail distribution through influence upon food supply. This statement is necessarily pure surmise because of our meager knowledge of the ecology of the marshes and of the clapper rail. There is indeed need for a comprehensive study of the natural history of the species along the lines suggested by the writer (The Gull, 22, 1940: 45-46).

Because the information on clapper rails' food is so incomplete and because food supply may importantly influence their distribution, this contribution, based upon analyses of stomach contents of 18 individuals, is thought to be justified. This number of specimens was collected by Dr. R. T. Orr and the writer on February 4, 1939, for the ornithological collection of the California Academy of Sciences. The rails were taken at the interval of a high tide (9.1 feet), from noon to 1:30 p.m., in flooded salicornia marshes bordering San Francisco Bay about 3 miles southeast of Palo Alto, Santa Clara County. Rails were extremely abundant there. Although no population densities were estimated, at least 100 rails were noted within an area of less than a square mile, considerable part of which consisted of a broad slough that would have held some water even at periods of low tide.

Stomachs of these rails were preserved and sent to the Fish and Wildlife Service, United States Department of the Interior, where their contents were examined by John C. Jones. Reports of these analyses form the basis for this paper. Grateful acknowledgment of this service is hereby made.

The condition of the stomachs ranged from one-tenth full (0.2 cc. volume) to gorged (7.8 cc. volume). The average content was 2.1 cc., which represented a well filled stomach. All of the food was contained in the stomachs, the gullets being empty, as might be expected in rails collected at high tide, since most food is available at periods of low water.

Volumetric content averaged over 85 per cent animal matter, and 14.5 per cent vegetable matter. No gravel was found in any stomach. Perhaps this is not available in the muddy marshes and doubtless it is unnecessary, its place being taken by the hard refuse, shells, etc., from the rails' food.

The table provides an itemized list of the stomach contents and includes all items which composed more than one per cent of the average content. Items which comprised less than this percentage by volume are mentioned in footnotes to the table.

Analyses by volumetric percentage of contents of 18 stomachs of *Rallus obsoletus obsoletus* from San Francisco Bay

	Volume of contents (cc.)	Total percentage of animal food	Percentages of individual animal foods					Vegetable food
			Modiolus demissus	Lycosidae	*Macoma balthica*	*Hemigrapsis oregonensis*	*Ilyanassa obsoleta*	*Spartina leiantha*
J. M. 2139[1]	1.3	100	16	72		12		
J. M. 2140[2]	4.0	60	48	10			1	40
J. M. 2141	7.8	92	19	73				8
J. M. 2142[3]	0.6	100	98	Tr*		2		Tr
J. M. 2143	1.3	100	89	Tr	Tr		11	
J. M. 2144	1.3	99	65	34	Tr			1
J. M. 2145[4]	1.6	100	97					Tr
R.T.O. 1738	0.2	100	98	Tr	2			
R.T.O. 1739	0.7	52	52	Tr				48
R.T.O. 1740[5]	1.1	96	52	42	2			4
R.T.O. 1741[6]	1.7	100	22	36	30			Tr
R.T.O. 1742	4.0	59	55	1	Tr		3	41
R.T.O. 1743	5.1	42	24	Tr		4	14	58
R.T.O. 1744[7]	0.7	100	96	Tr	3			
R.T.O. 1745	0.7	99	84	1	14			1
R.T.O. 1746[8]	0.6	91	51	Tr		40		9
R.T.O. 1747	2.7	48	37	2	1		8	52
R.T.O. 1748	2.7	100	15	Tr	85			Tr
Average:	2.1	85.44	56.5	15	7.6	3.2	2	14.55

*Tr=Trace=less than one per cent of volume.

[1] One predaceous ground beetle (*Bembidion*) comprised trace of stomach contents.
[2] Remains of 8 or more worms (Nereidae) comprised one per cent of contents.
[3] One bee or wasp (Hymenoptera) comprised trace of contents.
[4] Jaws of 14 or more worms (Nereidae) comprised 3 per cent of contents.
[5] One small snail (*Syncera translucens*) comprised trace of contents.
[6] Bone fragments of a brush rabbit (*Sylvilagus bachmani*), no doubt obtained as carrion, comprised 12 per cent of stomach contents.
[7] One fly (Otitidae) comprised one per cent of contents.
[8] One mud beetle (*Heterocerus*) comprised trace of contents.

Animal food.—Eight of the 18 stomachs contained animal food exclusively, except for traces of vegetable matter in four of them. All but two of the stomachs contained a preponderance of animal matter, the exceptions containing 42 and 48 per cent of animal substance.

It is interesting that the exotic plaited horse-mussel, *Modiolus* (*Volsella*) *demissus*, should form so high a percentage of the birds' food. This species is thought to have been introduced into San Francisco Bay with shipments of eastern oysters prior to 1894, and it is now established as a common inhabitant of the mud flats (Hanna, Bull. Dept. Agr. Calif., 28, 1939:305). It was represented in all of the stomachs by numerous shell fragments. This mollusk amounted to over 66 per cent of the rails' animal food. This is of interest because it has not previously been reported as being a food of *Rallus obsoletus*, and further, because De Groot (Condor, 29, 1927:266) has accused it of being an enemy of the rails by trapping them by the bill or toes between its shells. Several of the rails whose stomach contents are here considered were missing one or more toes, presumably from this cause. In view of the important place that this mussel occupies in the diet of the present sample of rails, it cannot now be regarded

entirely as an enemy of the bird. It is even conceivable that its presence may be more beneficial than detrimental to the rail population, which is another matter that cannot be answered short of conducting a careful study.

Spiders of the family Lycosidae, common inhabitants of wet and marshy places, were second in importance. Fragments of these spiders occurred in all save one of the stomachs, and in measurable quantities in half of them. Two stomachs contained 73 and 72 per cent, respectively, of remains of these animals; in the latter case the percentage represented more than 12 spiders. This food amounted to 15 per cent of the whole and over 17½ per cent of the animal matter found in the entire lot. Spiders have not previously been reported as being a food of this bird.

The little macoma clam (*Macoma balthica*), represented by shell fragments found in 10 stomachs, occurred in measurable quantities in only 7 examples. Except in two instances where this mollusk constituted 85 and 30 per cent of a stomach's contents, this item did not assume important proportions. It formed 7.6 per cent of the diet of the aggregate and nearly 9 per cent of the animal food. The low rank of this food among the present sample is in contrast to Williams' (*op. cit.*) observations from which he concluded that the clam was the principal article of food of rails which he observed in November and December of 1928. His records were made within three miles of the locality in which the present lot of birds was collected and are accompanied by excellent photographs and a description of how the rails procure and eat this clam.

The yellow shore-crab or mud crab (*Hemigrapsis oregonensis*), was found present in only four instances. In each case, remains of a single crab were found. Based upon both this low frequency and the low percentage by bulk, amounting to only 3.22 per cent of the whole, this crustacean played a minor part in the rails' diet. This is in contrast to Grinnell, Bryant and Storer's account (*loc. cit.*) where it is stated that parts of this crab were the only food found in stomachs of several clapper rails collected at Bay Farm Island, Alameda County.

The worn-out nassa, *Ilyanassa* (*Nassarius*) *obsoleta*, is a small snail, which, like the plaited horse-mussel, was introduced into San Francisco Bay with shipments of eastern oysters (see Hanna, *op. cit.* :304). Williams (*op. cit.* :56) mentions that these snails, which were lying about on the surface of the mud, were apparently untouched by the birds. The present analyses seem to confirm this observation, for if the snails were also abundant where the rails were collected, few were taken by the birds. The percentages in the table for individual stomachs represent from one to more than nine snails in five instances. The low aggregate percentage by bulk (2 per cent) indicates that this is not an important food item, and this is supported by Williams' observations.

Emerson (Orn. and Ool., 10, 1885:142) stated that worms and insects mostly composed the clapper rail's food. This statement is probably in part responsible for Grinnell, Bryant and Storer's contention that "the food is made up almost entirely of animal matter—worms, crustaceans and the like." It has already been remarked that crustaceans composed only a little more than three per cent of the present birds' food. Worms (Nereidae) occurred in almost negligible amount. Remains found in only two stomachs represented at least 8 and 14 worms, respectively, and amounted to one and three per cent of the individuals' diet. In the last instance, jaws of 14 worms comprised this percentage of bulk; before digestion the worms themselves would doubtless have contributed a higher percentage. Nevertheless, this item was inconsequential in the present sample.

Insects of four kinds occurred in as many instances. In each case, only a single insect was found (see footnotes to table). In all save the case of the fly, this material did

not occur in measurable quantities. It should be borne in mind that these rails were collected in mid-winter, when insect life was at a low ebb. Higher percentages of insect food are probably taken in summer.

The instance in which brush rabbit (*Sylvilagus*) bones formed 12 per cent of a rail's stomach contents is noteworthy as indicating the omnivorous character of the bird. Doubtless this material was obtained in the form of carrion.

Vegetable food.—Seed and hull fragments of the marsh cordgrass (*Spartina leiantha*) occurred in all but four of the stomachs. Measurable quantities were found in ten stomachs and amounted to as high as 58 and 52 per cent in two instances. In terms of percentage by bulk of the aggregate, this food ranked third in importance, averaging 14½ per cent. It was therefore an item of some significance. Because the rails were collected in mid-winter, it is likely that the percentage represents about the maximum of vegetable diet. This is the only vegetable species that was found in the stomachs. It is an abundant plant of the margins of the salt marshes. Williams mentioned that clapper rails sometimes feed near the grasses fringing their territories along sloughs. It is also possible that our rails show an abnormally high percentage of grass seed because they were collected during an unusually high tide when the grass was still exposed but most of the animal food deeply submerged.

SUMMARY

Ecological differences, perhaps differences in food supplies, may account for the irregular distribution of the California Clapper Rails of San Francisco Bay. Little has been published on the species' food habits.

The present contribution is based upon a sample of 18 rail stomachs collected near Palo Alto on February 4, 1939. Analyses were made by the U. S. Fish and Wildlife Service. Animal food constituted 85.5 per cent and vegetable food (seeds of *Spartina leiantha*), 14.5 per cent by bulk. No gravel was found.

A breakdown of the animal food indicated that the exotic horse-mussel (*Modiolus demissus*) was of greatest importance, amounting to 66 per cent of the animal food. This mollusk has been stated to be an enemy of clapper rails. Spiders were next among animal foods and were followed in importance by mud clams. Mud crabs and snails constituted low percentages. Worms and insects occurred in negligible quantities. Rabbit remains (carrion?) were found in one stomach.

California Academy of Sciences, San Francisco, California, June 18, 1941.

ROOSTING HABITS OF THE CHESTNUT-BACKED CHICKADEE AND THE BEWICK WREN

By LAIDLAW WILLIAMS

Although considerable work has been done on the first morning and last evening songs of birds, little has been written on the actual time of arrival and departure at the roost. Wynne-Edwards (1931:351) found that the time that Starlings left the roost varied considerably at different seasons in England. Mrs. Nice (1935) watched the times of roosting of the Starling and Bronzed Grackle in Ohio for a period of ten days in September and October and found a close correlation in both species with light intensity, as measured by a photometer, and also a difference in time between species. Emlen (1937:82) found that a female Mockingbird awoke later in relation to sunrise as the nesting season approached and that "light-intensity is the only factor which consistently showed a positive correlation with the bird's behavior."

The present study concerns the roosting habits of four Chestnut-backed Chickadees (*Penthestes rufescens*) and three Bewick Wrens (*Thryomanes bewickii*) in and near Carmel, Monterey County, California. The period covered is from June 28, 1940, through March 31, 1941.

Although the work was mainly concerned with the actual time of alighting on the sleeping perch, some records of the time of leaving the roost in the morning were made in order to compute the length of the birds' day and night. Light readings were made for correlation with the number of minutes before or after sunset that the birds went to roost and with weather conditions.

Equipment for the work was meager and far from satisfactory. However, the use of simple and inexpensive apparatus has the advantage of making available to a large number of observers of other species data that may form a basis for comparison. My equipment consisted merely of a constantly regulated wrist watch, a cheap electric torch, and a Weston Model 650 Universal Exposure Meter. This instrument registers light intensities in "candles per square foot" and only in certain block intervals. No attempt was made to "break down" these intervals in order to get more precise figures. This meter does not register intensity below ¼ candle per square foot. Thus, although it was possible to ascertain the light intensities at roosting time for all the chickadees and for wren No. 1, which came to roost at comparatively high light intensities, it failed for wren No. 3 because this individual generally "went to bed" at light intensities too low to be registered.

The readings were made with the meter directed as nearly toward the zenith as possible at standard reading places where the light from the sky was unobstructed.

Weather notations are divided into four categories: fair, cloudy, high fog, and rain or low fog. The rare low fogs were classed with rain as they were often hardly distinguishable from a drizzle.

Observations were made on one or more of the birds on 175 days in the course of the nine-month period. Fifteen were made on chickadee roost No. 1 between June 28 and August 6. Wren roosts No. 1 and No. 1a were watched daily from August 4 through December 3, except on 12 occasional dates. Frequent observations were made at chickadee roost No. 3 from October 22 through February 22. Observations were made at wren roost No. 3 from February 21 to 24. Daily observations on these last two covered the period from February 26 through March 31. Although these two roosts were about half a mile apart it was possible to follow both because of the later roosting time of the

wren. I planned to arrive at each roosting place about half an hour before the expected time of roosting. However, occasionally in March the chickadee arrived close to sunset time, instead of some twenty minutes before as was its custom, thus considerably cutting down the preliminary half hour of observation at the wren roost. Observations at chickadee roosts 2, 4, and 5 and wren roost 4 were made on a few occasions only.

Chestnut-backed Chickadee roosts.—On June 28, at 6:45 p.m., a chickadee was found perched on a loop of half-inch wire cable with its feathers almost touching the underside of an eave of a house (roost 1). The bird usually perched more or less longitudinally on the cable. The feathers of the body were much ruffed out and the tail partly spread (fig. 77). During the early part of its roosting time the bird was discovered either "looking" or else was easily awakened when examined by the light of a two-cell electric torch held 6 to 8 feet away. Later in the evening it would remain in sleeping position in spite of several G.E. Mazda photo-flash bulbs discharged as close as 4½ feet from it, although on two occasions it raised its head briefly.

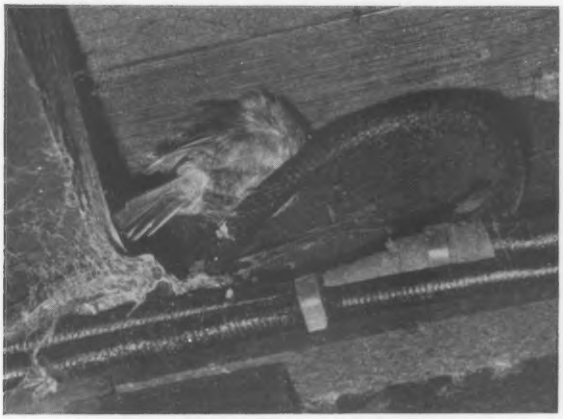

Fig. 77. Chestnut-backed Chickadee in roosting posture. Roost No. 1, Carmel, Monterey County, California, July 22, 1940.

On the night of August 6 this chickadee was caught in the hand on the roost and color-banded. The bird was retained in a box overnight and released close to the roosting place at about the time it had been known to leave the roost in the morning. Although it was frequently seen in the vicinity during the day for some time afterward, it was never seen to go to this roost again. No other attempts at banding roosting birds were made.

Another chickadee fluttered from its perch (roost 2) on the opposite side of the same house when a two-cell electric torch was held within 8 inches of it on the evening of its discovery. Although the bird was recaptured and replaced, this roost was never found to be used again.

Chickadee roost No. 3 was discovered on October 22. The bird was perched on the stem of an English ivy leaf and was almost concealed by the leaves of that vine which covered about 70 square feet of the east wall of another house. This wall was protected by an extension of the main roof, forming a porch about four feet deep. This chickadee

was almost, if not actually, touching the underside of the porch roof, as numbers 1 and 2 did the eaves. This and two other similar perches were principally used. However, on a few nights the bird went to other slightly lower ivy stems, sometimes several inches below the ceiling boards. These perches are all called "roost 3" and the bird using them "3A," or simply "A," when distinguishing it from its mate. The ivy leaves so concealed the bird that a view of it was to be had only from one angle. The roost was almost completely sheltered from the weather. On the principal perch the bird carried the tail almost horizontally, as the bird at No. 1 did, and the body feathers were much ruffed out; it was observed always to face toward the south.

On November 2, the date that arrival at roost 3 was first timed, it was noted that two chickadees were present shortly before one of them went to roost. The presence of two birds in the neighborhood was noted on many occasions thereafter. After March 4 two birds were always present. No more than two birds at a time had been seen since early in the period of observation. The pair generally went to the suet at a feeding station fifteen feet from the roost; then shortly A would go to roost. The other, B, would eat more suet, then, after an interval, fly over the roof of the house toward the west. The movements of B were followed as it foraged along more or less the same route every evening: over the roof to a hedge, to a poison hemlock stalk, a flight of about 100 feet to a pine, then across a street and around the corner of another house and out of sight. It is presumed that B was also going to roost, as it was not heard after rounding the corner of the house mentioned. The times that B was last seen or heard varied from 2 to 39 minutes after A went to roost.

On March 2 this routine was altered to the extent that both birds flew in under the porch roof at 5:37 p.m. A went directly to the roost; B perched first on the outer tips of the ivy, then went toward the wall, then out again, finally leaving the porch entirely. B's whole manner while under the porch roof was tentative and hesitant. At 5:42 B was seen at the suet.

On March 7 the same sort of action was seen again, but on this occasion A also went out again with B. At one minute after sunset A returned to the roost and remained. One minute later B went over the roof in the usual manner.

About noon on March 9 a chickadee was seen gathering moss from the edge of the lawn in front of roost No. 3 and flying to and entering a bird box on a Monterey pine at the opposite end of the lawn, about 70 feet away. That evening the roosting routine was again noted to be changed. A remained in the vicinity of the nest box while B flew over the roof in its usual manner 3 minutes after sunset. Then A flew alone to roost No. 3, six minutes after sunset. March 7 and 9 were the only two occasions when A went to roost after sunset. Again on March 10, B seemed about to roost with A, coming to the vine three times before leaving in the usual fashion.

Bird A was recorded for the first time roosting in the box on March 18. From that time on A always roosted in the box. The first egg was laid on March 24, the seventh day after the first box roosting. Incubation started 5 days later (March 29) after the laying of the sixth egg. After this no roosting times were recorded. During the period of box roosting, A reverted to early roosting again, coming as early as 51 minutes before sunset on March 28. Incubation started the next day.

Five days before the first egg was laid, but after A had been roosting in the box for at least two nights, observations were made at the box on the morning of March 20. At 5:36 a.m. stars and a half-moon were out; the sky was entirely clear. At 5:44½ no bird had left the box but a chickadee was seen in the tree on which the box is hung. This bird flew to the entrance of the box, then to perch on a bush in front of the box,

where it preened for some time, occasionally calling *see-see-see*, then back to the box entrance, and so forth. This procedure continued until 6:10 when, as the visiting bird (presumed to be B) was perched quietly on the bush, a chickadee (A) popped out of the hole and flew to a near-by acacia. Instantly B also flew to the acacia and lit near the other. Thus what was presumably bird B came to the box at 5:44½ a.m. and seemed to wait for A's appearance 25½ minutes later.

That A and B were paired when observations began in early November, or soon after, seems fairly well indicated. There have been banding records which showed that pairs of *P. atricapillus* remain intact throughout the winter (Baldwin, 1934, 1935). There is indication that several European tits remain paired through the winter (Lack, 1940:271).

To summarize, bird A, which roosted at first at No. 3, began roosting in the box before eggs were laid, later commencing incubation. It also tended to be quieter than bird B, and did not perch conspicuously or make loud call notes as the latter did before roosting time. A, therefore, may reasonably be supposed to be the female of the pair and B the male. That being the case the female averaged about ten minutes earlier than the male in going to roost. The single exception was on March 9 when B flew over the roof three minutes before A went to roost. This was during the period when A shifted from the roost to the nest, and her time on that day, six minutes after sunset, was the latest noted for any chickadee.

Morley (1939:41) states that the male of a pair of Starlings went to the roosting hole after the female and left before she did. Unlike the chickadees, they roosted in the same hole. He found the roosting time for the pair late, and the male's behavior uncertain in the period of transition from roosting with the flock to roosting in the future nest hole. This may be compared with the late roosting times for both chickadees and the tentative behavior of the male between March 2 and 9.

Only a few observations were made at roosts 4 and 5. Roost 4, close under the eave of a third house, was known to have been used by a chickadee in the winter 1934-35, as well as during the present period of observation. Roost 5 was in a cavity in the side of an old hornets' nest about fifteen feet above the ground under the eave of a fourth house. This cavity appeared not to have been made by the hornets. Kalter (1932) records a Carolina Wren roosting in a large old hornets' nest hung in a dark corner of a house. A Mountain Chickadee (*P. gambeli*) was found roosting in an abandoned nest of the Western Robin 10 feet up in a lodgepole pine (Bassett, 1923). Both chickadee 4 and 5 were accompanied to roost by another chicakadee which was heard actively calling from 8 to 13 minutes after the observed roostings occurred. Time and light intensity readings for these roostings fell within the range of those for numbers 1 and 3.

Bewick Wren roosts.—Audubon (1939:468) quotes Bachman as having seen Bewick Wrens coming from roosts in a hollow tree (presumably in the southeastern states). E. I. Dyer, as quoted by E. V. Miller (1941:85) in the latter's behavior study of this species, records Bewick Wrens using a nest box for roosting in Piedmont, California. Because Miller states that he failed to find the roosts himself, my observations on this subject may be of some interest.

A wren roost was discovered on the side of the same house as chickadee roosts 1 and 2. The house is faced with rustic slabs of redwood bark applied vertically. Wren No. 1 roosted in a crack between two of these slabs, resting on a third slab that was fastened horizontally across the lintel of a wide window on the south wing of the house. The bird used this roost from August 4 until October 6 when it went to an almost identical situation (roost 1a) on the north wing of the house (fig. 78). After November 1

Fig. 78. Bewick Wren in roosting posture, revealing subterminal spots on feathers of rump. Roost No. 1a, Carmel, California, October 20, 1940.

it used both of these roosts, but on different nights, and also a third roost close under an eave in a deep crevice in the bark where the bird was partly concealed.

The wren went through a similar routine each evening, as did the male chickadee. When it was going to roost 1, for instance, it would be heard giving a few single "harsh drawls," as I have called this note. Soon it would be seen near the end of an acacia branch about 5 feet from the roost. There the bird would pause, twitch nervously from side to side, and utter the harsh drawl more loudly this time, in a series of 3, 4, and 5, each utterance being shorter than when given singly. It did this for a period varying from half a minute to three minutes. The moment it lit on the roost the bird became silent. On rare occasions the wren came silently to roost, but nearly always the series of notes was uttered up to the instant of flying to the roost. Later, when I was locating the various roosts of wren No. 3, these notes, heard at the proper time of evening, served as a fairly certain give-away.

E. V. Miller thinks that this roosting note, as I have described it to him, is the one he syllabified in his paper as *spzz*, and agrees with me that it is the harshest note in the wren's varied repertory. He remarks further that the male employs this note, with others, in "territorial encounters." Perhaps the daily routine of uttering this note from a particular tree just before going to roost, as I have recorded it, is a further expression of territorial intolerance, the last uttered before retiring. No other wren has been present at such times, however.

In the roosting posture the bird ruffed out the body feathers, particularly those of the lower back and rump, to an extraordinary degree. Thus ruffed, these feathers showed the subterminal white spots (fig. 78). This sight at first surprised me, as I had been entirely unaware of these spots. Similar concealed white subterminal spots have been found on the feathers of the lower back and rump of museum specimens of the House Wren (*Troglodytes aedon*), Winter Wren (*Nannus hiemalis*) and the Canyon Wren (*Catherpes mexicanus*). The Rock Wren (*Salpinctes obsoletus*) has no such spots.

The question suggests itself whether the ruffed-out pose with its irregular outline and revealed spots might function as a protective adaptation on the theory of broken

contours. However, it would be very difficult to say to what greater extent, if any, the bird blends with its surroundings thus ruffed out than in normal posture. Although two of this bird's roosts were entirely exposed to view, it was difficult for the human observer to detect the bird there even before it ruffed out.

Wren No. 3 used two types of roosts. Roost No. 3x, used for all but five of the observed roostings, was situated on the limb of a Monterey pine about 15 feet above the ground. The bird always perched on the limb close to a dead cone and beneath a canopy of fallen brown needles which had been caught by a few twigs and tufts of live needles above the main limb and over the cone. Roost No. 3y (seen to be used only on one

Fig. 79. Bewick Wren No. 3 in roosting posture, at roost 32, March 12, 1941.

occasion, February 28) was similarly situated on the limb of another Monterey pine, except that the canopy of needles was more extensive and there was no cone. Roost No. 3z, used on four rainy nights only, was on a small wire about seven feet from the ground against the wall of a house. Here the bird held its body against the wall close to a batten and was protected by an overhanging eave, although not immediately beneath it, as were the chickadee roosts. On March 12 the posterior end of the white superciliary stripe was seen when the bird was in sleeping posture with its head turned back over the right shoulder (fig. 79).

Wren No. 3 was a male. Its roosting routine was, for the most part, the same throughout the early period of observation. The bird would be heard calling or singing on various perches and occasionally uttering harsh drawls, nearly always progressing toward a small live oak, where it perched a few feet from, and slightly below, roost No. 3x. There it gave the harsh drawl (*spzz* note) in a series, as did wren No. 1 just before going to roost, each note and each series of notes being even more loudly and rapidly delivered

at this point in the routine. Sometimes the drawls were muffled when the bird attempted to preen at the same time.

On two occasions the bird was heard singing from the top of an 85-foot Monterey pine, following which it flew directly down to the live oak, a drop of 75 feet. Then it gave the harsh drawl before flying to the roost in the usual way.

On March 23 the bird was lost track of just before roosting time. It was last heard in the vicinity of a large Monterey pine with low sweeping branches, called "spreading pine." On March 26 the harsh drawl was heard first in the vicinity of the spreading pine; later the bird gave it in the usual live oak and went to roost No. 3x. On March 27 the harsh drawl was heard near the same pine but the bird was not found and did not come to any of his usual roosts. On March 28 a pair of wrens was watched in an oak thicket

Fig. 80. "Spreading Pine," location of roost No. 4 used by female Bewick Wren. Roost site near end of down-sweeping branch in lower center of photograph.

near the spreading pine. One of them was lost; the other was followed to roost No. 3x. On March 29 No. 3 was again discovered in the same oak thicket with a second wren. Both a *skuz-uz-uz* and a high clear note were heard softly and constantly from this pair. At 6:38 p.m. they both went to the end of one of the limbs of the spreading pine and one of them disappeared there (fig. 80). Then the remaining bird uttered the harsh drawl, and at 6:44 flew in the direction of roost No. 3x, 250 feet away; the usual harsh drawl was heard from the direction of the live oak near the roost, and I reached the place just as he was slipping on the roost.

Search later that evening disclosed the second wren, No. 4, on a roost at the end of the pine branch where it had disappeared. It was in typical posture, ruffed out, spots showing, in a little niche in the side of a large mass of fallen needles caught in the pine branch about 7 feet above the ground (fig. 81). This niche, examined in daytime, looked as though the needles might have been shoved a bit aside to form a cavity more or less

fitted to the bird's body. However, as no such action was witnessed, it is entirely possible that the recess was fortuitously formed by the falling needles. As at all the wren roosts inspected, no sign of excreta could be found at the threshold. This is in contrast to the chickadee roosts all of which were made conspicuous by droppings on or beneath the roosting perch.

Skutch (1940:297) describes dormitories especially constructed by wrens of several genera in Central America. These were often different in structure from the breeding nest, and were used for roosting by one or more individuals at a time.

On March 30 the normal roosting routine was followed by the two Bewick Wrens, preceded by copulation. The female went to roost 4 and the male to roost 3z. The following morning wren No. 3 left this roost at 5:20 a.m. Immediately I went to roost 4.

Fig. 81. Bewick Wren roost No. 4, with bird visible in recess in accumulation of pine needles; March 30, 1941.

When I arrived there I heard the *skuz-uz-uz* note of the male and with the aid of a torch saw the bird clinging to the side of the mass of dead needles, a few inches from the female who still was roosting. He remained there for twelve minutes, until she came off. Then they moved about in the chaparral for a few minutes, No. 3 continuing the *skuz-uz-uz* note softly, No. 4 uttering the same high clear note as was heard on the preceding evening. Then copulation took place, No. 3 mounting.

During the 30½ minutes that the pair was under observation on the preceding evening and in the hour and 50 minutes after No. 3 left the roost on this morning, singing was heard only twice; one song preceding each copulation (both days were rainy). No nest or nest building activity was seen.

On the evening of March 31 similar roosting routine was noted, ending with the male going to roost No. 3z.

Comparison of the species.—In comparing the roosts of the Chestnut-backed Chickadee with those of the Bewick Wren, it may be noted that all five chickadee roosts were beneath the eaves of buildings. Although wren No. 1 always used the sides of a building, wren No. 3 used two types of roost, one on a building, the other beneath a canopy of fallen needles caught on a pine limb. This latter type also was used by wren No. 4, the female.

It was frequently noted that both wrens and chickadees did not assume the posture of sleep for some time after they had reached the roost, and that they were easily frightened off during this early period. Later in the evening, when in the sleeping position, birds of neither species were easily disturbed by lights and noises at close range. Wren No. 1 was photographed in sleeping posture with the aid of a Wabash No. 2 Superflood light bulb, held within 6½ feet and kept illuminated for 10 minutes or more while exposures were made. Wren No. 3, also while in this posture, was subjected to the intense, but brief (1/20 sec.) illumination of a Wabash No. 2A photoflash lamp at 6 feet. It did raise its head on one occasion, but soon replaced it. Similar behavior was noted for the chickadee (see p. 275).

Roosting times.—The average roosting time of all the chickadees was earlier than that of any of the wrens (in terms of minutes before or after sunset). The chickadee times were found to vary more than those of the wrens and to precede the sunset curve. A shaft of sunlight actually struck the side of the building close to the roosting place of chickadee No. 1 on one occasion when the bird was found already on the perch, but awake. Wren No. 1's average time was within a fraction of a minute of sunset and wren No. 3's was 11.9 minutes after sunset (table 2).

This variation between the two wrens (1 and 3) might be either individual or seasonal. Allard (1930:446 and fig. 2) noted two individual House Wrens that delivered their first morning songs at quite regular intervals a few minutes apart. That it may be at least partly seasonal in the present instance is suggested by the fact that when wren No. 1's average time is divided into two periods of equal length immediately preceding and immediately following the September equinox, the average time for the first period, August 4 to September 21, was 2.23 minutes before sunset and the average from September 22 to November 9 was 2.39 minutes after sunset. Still later in the winter, from November 11 to 24, the average time was 8.3 minutes after sunset. Nice (1939) describes three different stages of the yearly cycle during each of which the Song Sparrow delivers its "awakening song" at different times according to seasonal and other factors.

TABLE 1

Time spent on the roost

Date	Wren	Chickadee	Difference
Aug. 5-6		(No. 1) 10 h., 30 m.	30 m.
Aug. 6-7	(No. 1) 10 h.		
Feb. 26-27	(No. 3) 12 h., 26½ m.	(No. 3A) 13 h., 41½ m.	1 h., 15 m.
Mar. 19-20		(No. 3A) 12 h., 1 m.	1 h., 4½ m.
Mar. 25-26	(No. 3) 10 h., 51½ m.		
Mar. 30-31	(No. 3) 10 h., 39½ m. (No. 4) 11 h., 17 m.		

Sex differences.—Chickadee No. 3A, judged to be the female, roosted earlier than her mate. Wren No. 4, a female, roosted earlier than the male on the three occasions she was seen, and spent more time altogether on the roost (table 1). Morning observations on both species (one observation on each) seemed to indicate that the male "gets

up" earlier than the female and goes to the female's roost to wait for her, at least at the onset of the breeding season. In nearly all cases the male chickadee accompanied his mate to her roosting place in the evening and then went elsewhere to roost. This also applied to the wren on the few occasions when the female was seen at roosting time.

TABLE 2

Roosting times expressed in minutes before or after sunset at 36° north, 122° west

Weather	Chickadee 1	Chickadee 3	Wren 1	Wren 3	Wren 4
Fair					
Number of records	1	17	22	9	
Earliest time	−32.0	−43.0	−06.0	+07.5	
Latest time	−32.0	+00.5	+16.5	+18.0	
Average	−32.0	−18.5	+05.0	+14.4	
Cloudy					
Number of records	1	20	9	16	1
Earliest time	−32.0	−51.5	−05.5	+03.5	+11.0
Latest time	−32.0	+06.0	+07.5	+19.0	+11.0
Average	−32.0	−17.9	+00.7	+11.6	+11.0
High fog					
Number of records	3	2	14	2	
Earliest time	−42.0	−29.5	−15.0	+11.5	
Latest time	−22.0	−10.0	+06.0	+12.0	
Average	−33.0	−19.7	−04.0	+11.7	
Rain and low fog					
Number of records		6	5	5	2
Earliest time		−60.0	−20.0	+02.0	−12.5
Latest time		−19.0	−01.5	+15.5	−03.0
Average		−42.0	−10.9	+08.1	−07.7
All weathers (totals)					
Number of records	5	45	50	32	3
Earliest time	−42.0	−60.0	−20.0	+02.0	−12.5
Latest time	−22.0	+06.0	+16.5	+19.0	+11.0
Average	−32.6	−21.4	+00.1	+11.9	−01.5

Effect of weather on roosting time.—It will be noted (table 2) that the average roosting times of chickadee No. 3 in fair, cloudy, and high-foggy weather varied less than two minutes (17.9-19.7 minutes before sunset), while the average for six rainy evenings was over 22 minutes earlier than that for any other weather. Wren No. 1's average roosting times are progressively earlier from fair, through cloudy and high-foggy, to rainy weather, showing a difference of 15.9 minutes between fair weather and rainy, and crossing the sunset curve. Wren No. 3's average was also materially earlier in rainy weather than in any other kind.

Effect of light intensities.—It will be noted (table 3) that the 30 readings for chickadee No. 3A ranged from ' 6 to 320 candles per square foot. Of these, 23 fell within a range of 25 to 100 candle which may be taken to be the normal range.

As previously mentioned, wren No. 3 generally roosted at such low light intensities that no readings were possible. It will be noted that the 39 readings for wren No. 1 all fall below the chickadee's normal range and that the range of the wren is more compact than that of the chickadee.

Emlen suggests that the later rising of his Mockingbird on rainy mornings might be the effect of weather through light intensity. Allard (1930) in considering the time of the first morning song of birds says (p. 465), "In a sense it would appear that their visual organization behaves as a very sensitive protometer, appreciating very low light

TABLE 3
Correlation of roostings with light intensities

Weston readings	1	1.6	2	4	5	8	10	13	16	20	25	32	40	50	65	80	100	130	160	200	250	320	
Chickadee No. 3A																							
Weather																							
Fair							1	1			1	3	1	2	1	2							
Cloudy		1				1		1				2	2		1	1	2		1				
High fog											1												
Rain											1	2				1						1	
Total roostings		1				1	1	2			3	7	3	2	2	4	2		1			1	=30
Wren No. 1																							
Weather																							
Fair	3		2	2	3	4	1		1	1													
Cloudy	1			1		1	3	2	1														
High fog				1		1	4	2	1	1													
Rain							1	2															
Total roostings	4		2	4	3	6	9	6	3	2	=39												

intensities . . . . Since cloudiness at dawn tends to delay more or less appreciably the delivery of the first morning song, I am inclined to believe that the intensity of light of the visible spectrum operates upon the visual organization to cause the birds, each with its own sensitivity, to strike the minute approximately at which its mechanism is set."

Although both the chickadee and the wren went to roost appreciably earlier on rainy evenings, any direct effect on this time by the lower light intensity in such weather is not indicated. Rather it was found that the birds tended to come to roost at somewhat higher light intensities in rainy weather. Too few recordings were made in rainy weather to generalize, but none of these fell in the lower light range of either bird. On one rainy evening the chickadee came a full hour before sunset at 320 candles per square foot; its next highest intensity reading, 160 candles, was made the day before incubation started. No conclusion is possible. These figures are given merely to indicate a seeming tendency.

SUMMARY

The roosting places of 5 Chestnut-backed Chickadees and 3 Bewick Wrens were found. The study of these roosts covered the period from June 28, 1940, to March 31, 1941.

All the chickadee roosts were close under the eaves of buildings. The wren roosts were of two types: (1) on the sides of buildings, and (2) beneath a canopy of fallen dead needles on a Monterey pine bough.

All the averages of chickadee roosting times were before sunset, chickadee No. 3A's being 21.5 minutes before. The times for chickadees varied more from the sunset curve than did those of the wrens. The average time of wren No. 1 was within a fraction of a minute of sunset, that of wren No. 3, 12.3 minutes after sunset.

The difference in roosting time of wrens 1 and 3 may be seasonal, or individual, or both.

A sex difference in roosting behavior was found in the chickadee pair studied, and was also indicated for a pair of wrens, the males in both instances going to roost later.

The chickadees spent more time on the roost than the wrens.

There is some evidence to show that weather affects the roosting time of both species independently of light intensity.

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Carmel, California, July 19, 1941.

ADDITIONAL DATA CONCERNING THE SUBSPECIFIC STATUS OF THE CORMORANTS OF GREAT SALT LAKE

By WILLIAM H. BEHLE

On a previous occasion (1936) the writer presented the data then available to him bearing on the subspecific status of the cormorants that breed on Egg Island, Great Salt Lake, Utah. Since then, Mendall (1936:114), in connection with an economic study of the eastern Double-crested Cormorant (*Phalacrocorax auritus auritus*), has reviewed the systematic problem of the Great Salt Lake birds, pointing out the need for still further data before the racial affinities of the birds could be unquestionably established. Mendall's comments pertaining to this are as follows: "Regarding the Utah birds, the stomach records, taken in 1915 and 1916, were published by Lewis [1929:70] under *P. a. auritus*, since the A.O.U. *Check-List* (third edition) recognized this subspecies as the breeding Cormorant of the state. The fourth edition of the *Check-List* (1931), however, substituted *P. a. albociliatus* for *P. a. auritus*. Dr. Alexander Wetmore, who took the Utah specimens, has informed me, in a letter of February 28, 1936, that these birds were at first tentatively identified as *P. a. auritus*, and the stomach contents were recorded under this name. The skins were later examined by Dr. Harry Oberholser who determined that they belonged to the subspecies *P. a. albociliatus*. Recently, the work of Behle (1936) indicates that *P. a. auritus* may be the form now found in this state, at least in one of the colonies. Six specimens, examined by him, were taken during the early part of the breeding season in 1935 at Egg Island, Great Salt Lake. Five of these birds showed traces of crests and in four of the crests black plumes predominated. It is, of course, difficult to distinguish between *P. a. auritus* and *P. a. albociliatus*, although the former is usually slightly larger and shows a predominance of black plumes in the crest—the plumes of *P. a. albociliatus* being mostly white. No measurements were given by Behle concerning his specimens."

In Mendall's further discussion the point was brought out that the Utah birds may constitute a group of intermediates between the eastern and western subspecies. It appears, however, that Mendall considered the Utah birds as being *albociliatus*, for he states (*op. cit.*, p. 14) that "Utah has long been included in the breeding range of *P. a. auritus*, and was so treated by Lewis. It now appears that *P. a. albociliatus* may have been the subspecies found in this region at that time, although some uncertainty exists regarding the present status of the Cormorants of this state as well as those of New Mexico." Again on page 115 he says that "data on the Utah birds, collected by Dr. Wetmore, are not given, as the specimens are no longer regarded as pertaining to *P. a. auritus*."

In Mendall's statements there is an implication that there may have been a change through the years in the subspecies of cormorants nesting in the region, that the Farallon Cormorant may once have been the breeding bird of the Great Salt Lake region but that now the Double-crested Cormorant is to be found nesting. I do not think that such is the case. Whatever the racial make-up of the Utah cormorants may be, the birds have probably been the same throughout the years. The difficulty lies simply in differences of opinion among systematists as to the birds' identity. That such is the case is understandable where there is a paucity of material upon which to base judgments.

Cormorants in times past have nested on Dolphin Island in Great Salt Lake and at Bear Lake in northeastern Utah and southeastern Idaho. There are records of nesting sites in recent years in Cache Valley in the northeastern part of the state. Also of late

a colony has become established on some artificial islands at the Bear River Migratory Bird Refuge. When Mendall makes the statement that *P. a. auritus* may be the form now found in the state, at least in one of the colonies, he implies that perhaps the Farallon Cormorant may also be a summer resident of the state. Peters (1931:86), shares that opinion for he includes Utah in the range of both the Farallon Cormorant and the Double-crested Cormorant. I can not conceive of there being more than one race breeding in Utah. The distribution of cormorants throughout the West is extremely discontinuous owing to the nature of the terrain and the birds' habitat requirements. The distributional area of the Utah population is more or less restricted and isolated from those elsewhere. It seems to me that the cormorants in all the Utah colonies both present and past would show the same combination of characters and have the same racial affinities.

In order to contribute further to the determination of the subspecific status of the cormorants of the Great Salt Lake region, I have for the last four years, as opportunity arose, visited the Egg Island colony, collecting a few breeding cormorants each year. Seventeen additional adult specimens have thus accumulated. With the specimens previously at hand, there are now available for study 26 cormorants that have been taken in the last decade from Egg Island. Of these, 16 are males and 10 are females. These specimens afford data both as to coloration of nuptial plumes and size. All 26 are considered in the ensuing discussion, thus including those previously reported on.

Concerning the 16 males, 6 lack nuptial plumes entirely. Of those with plumes, one individual has one black plume on each side. Another has 3 white plumes on one side and one black one on the other. Another specimen has 4 black plumes on each side. Yet another has about 10 plumes on the left side, all of which are black except one which has the basal half white. This same specimen has 5 plumes on the right side of which 4 are black. The fifth has its basal half white. The remaining 6 cormorants have conspicuous "crests" on both sides of the head. The plumes in these clusters number for the most part in excess of 20 and in every case all the feathers are black.

As to the females, 6 likewise lack nuptial plumes. The 4 with plumes all show conspicuous "crests." One possesses plumes that are black for the most part, but a few feathers show white at their bases and a few scattered white feathers appear on the neck. In a second female about one-fourth of the plumes on each side are white; the rest are black. This is the only bird of either sex with any appreciable amount of white in the crests. Even in this individual the black plumes predominate. The other two specimens have entirely black plumes.

In addition to these specimens, a partly decomposed bird was found at Egg Island on April 21, 1940. The head, which shows conspicuous black crests, was saved. Furthermore, while collecting specimens, we were continually watching for individuals bearing crests. At no time did we see any white on the head region of the birds.

Considering the Great Salt Lake birds as a whole, they constitute a more uniform lot as to plume color than series of Pacific Coast examples of the race *albociliatus* that I have examined. Many west-coast birds show distinctly bicolored crests, and I have gained the impression that Pacific Coast birds are less uniformly white than the Great Salt Lake birds are uniformly black in plume coloration. The data afforded as to plume coloration by this series of cormorants from Great Salt Lake indicates that they have closest affinities with the eastern race of Double-crested Cormorant, *P. a. auritus*. The presence of a small amount of white in the plumes of some individuals should not detract from this statement when one keeps in mind the seemingly greater variability in this respect of birds taken much closer to the metropolises of the eastern and western races.

In taking wing measurements I was surprised to find how nearly alike were cord length and length of flattened wing, especially in specimens whose wings had been sewed through so that they were held tightly to the body. Owing to different "makes" of skins encountered, I think the flattened wing measurement is a better indication of size than the cord and so have used this in the accompanying table. The Great Salt Lake birds that were measured are for the most part in the Museum of Zoology of the University of Utah. Specimens measured from other localities are either in the collections of the Museum of Vertebrate Zoology or the California Academy of Sciences. Although only two specimens of the eastern race were available for comparison, the measurements of these are similar to those given by others for eastern birds. Indications from the data in the accompanying table are that the Great Salt Lake birds are intermediate in size between eastern and western birds, being larger than *albociliatus* and smaller than *auritus*. No comparable series of females was available for comparison. The ten females from Great Salt Lake have an average flattened wing length of 312 mm., thus indicating considerable difference between sexes in this character. The tails of most specimens are badly frayed. Measurements of culmen and tarsal length do not seem to show significant differences.

Location	Number and sex	Average flattened wing length
Kodiak Island, Alaska	3 ♂ ♂	353 mm.
Vancouver Island, B.C.	2 ♂ ♂	346
San Francisco Bay Area	5 ♂ ♂	322
San Diego Bay Area	7 ♂ ♂	319
San Martín Island, L.C.	6 ♂ ♂	321
Salton Sea, California	5 ♂ ♂	332
Great Salt Lake, Utah	16 ♂ ♂	327
Minnesota	2 ♂ ♂	345

On the basis of size it would seem that the Great Salt Lake birds are intermediate between the eastern and western races. However, taking into consideration the data on plume color also, I feel that as far as nomenclature is concerned they should be referred to *Phalacrocorax auritus auritus*, the Double-crested Cormorant.

To summarize the variational trends within the species as to the geographically variable characters, it seems that on the west coast of North America the cormorants have nuptial plumes that are white or predominantly white. Birds from the northern part of the west coast are large, representing the culmination of this character. This combination of white plumes and large size has led to their being designated as the race *cincinatus*. A progressive trend to the southward involving decreasing size sets in, resulting in a smaller race along the California coast known as *albociliatus*. Birds as far south as Vancouver Island and off the Washington coast, although intermediate in size, have been placed with *cincinatus*. Apparently a hiatus exists southward for some distance along the coast where no cormorant colonies occur. Where they are again found they are closest to *albociliatus*. From the west coast to the east coast the trend is toward increase in size and black plume coloration. Birds from interior California, as at Buena Vista Lake, Kern County (see van Rossem, 1936:217) and Salton Sea, are intermediates. Both populations show considerable mixture of plume color but white predominates thus indicating closest affinities with the Farallon Cormorant. The Great Salt Lake birds are intermediate as to size but on the basis of plume color they show closest affinities to the Double-crested Cormorant of the east. The break comes between Great Salt Lake and the Salton Sea; it would be exceedingly interesting to know the situation existing at the Pyramid Lake colony in Nevada. The birds of the east coast, as men-

tioned, are characterized by black plumes, but again a north-south size trend is encountered. In the northeastern section of the country is the large race, *auritus*, whereas in the southeastern coastal area the small Florida race, *floridanus*, exists.

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Department of Biology, University of Utah, Salt Lake City, August 2, 1941.

FROM FIELD AND STUDY

Nesting of the Flammulated Screech Owl in California.—After many years of search for the nests of Flammulated Screech Owls (*Otus flammeolus*) in the San Bernardino Mountains of California, I decided that if these owls were nesting it must be high up in the holes in huge dead stumps. It was also decided that the birds would not flush. These early conclusions proved to be false in at least one case.

My efforts were rewarded on June 1, 1941, by seeing a bird and finding the nesting site, which then held one fresh egg. This was at an elevation of about 7500 feet. Fred Frazer first noticed a hole only twelve feet up in a small dead fir stump with the bark still on it. He thought that he had seen something move at the entrance as we walked past and therefore called it to my attention. I investigated the stump at once, and upon touching its base, a Flammulated Screech Owl flushed from the hole and flew to a thicket of small pine trees about a hundred feet distant. We were able to approach the bird within about twenty feet and to observe it for fully half an hour before it flew to other trees, where we lost sight of it. We then secured a ladder and investigated the nest, which was down eleven inches from a natural opening, or a very old entrance made by birds, and saw a single white egg on the old rotted wood.

Fig. 82. Habitat of Flammulated Screech Owl in San Bernardino Mountains. Low branch of pine used as perch after flushing from nest.

A week later I again visited the site, with W. D. LaNiece, hoping to obtain some photographs of this exceedingly rare owl. On approaching the stump, we accidentally fell against it and caused the bird to flush. It flew only forty feet to a low branch of a pine tree where it perched for several minutes before it returned to the nest cavity. The bird again flushed as soon as the tree was touched and it went to the same branch as before for a few minutes before it returned to the eggs. We then put some rags on the end of a long stick and were able to stuff these into the entrance hole and capture the bird. During all of this work around the stump there was a Bailey Mountain Chickadee (*Penthestes gambeli baileyae*) making frequent trips to feed her brood of young in a hole not three feet away in the same stump.

The owl was not antagonistic and made no effort to bite or use its sharp claws, nor did it seem to try to escape. The dark chocolate-colored eyes of this gentle little bird attracted our attention, as they were so different from the eyes of other owls.

The eggs were three in number and the weights in grams, 10.69, 10.24, and 9.11. This seems to be the second set of eggs taken in California, the first being a set of two eggs collected by M. French Gilman, June 3, 1894 (Condor, 4, 1906:85). The eggs are larger than those of the Whitney Elf Owl,

Fig. 83. Flammulated Screech Owl. Note dark eyes.

Micropallas whitneyi whitneyi (average weight of 50 eggs, 7.31 grams), and much smaller than those of our local Pasadena Screech Owl, *Otus asio quercinus* (average weight of 52 eggs, 17.59 grams).—WILSON C. HANNA, *Colton, California, September 4, 1941.*

Black-billed Cuckoo in Idaho.—On the morning of July 10, 1941, at my camp on Slide Gulch on the Middle Fork of the Boise River in Boise County, Idaho, I was awakened by the call of a cuckoo. The call originated from a thicket of bushes near by, and as this was the first cuckoo I had heard in the state, I determined to collect it. The bird could not be located in the thicket, but soon it flew into a tall cottonwood tree by camp and finally into a small bush near the river, where it resumed its calling. There I saw the bird as it perched motionless and was able to collect it.

Upon skinning the cuckoo, it was noted that the ova and oviduct were enlarged, the largest ovum being 11 mm. in diameter. Expecting a California Cuckoo, I was surprised to note certain points of difference. Final identification as the Black-billed Cuckoo (*Coccyzus erythropthalmus*) was made at the Museum of Vertebrate Zoology. This skin is no. 1814 in my collection.

I have been unable to find previous records of the occurrence of this species in breeding condition west of the Rocky Mountains. Its range must therefore be extended to include the western portion of the state of Idaho.—M. DALE ARVEY, *Boise Junior College, Boise, Idaho, September 12, 1941.*

Further Notes on Some Southwestern Yellowthroats.—A number of years ago (Condor, 32, 1930:297-300) I gave a summarized review of the yellowthroats of southern California, southern Arizona, and Sonora. Since that time a large amount of additional material has been seen, but in spite of this I have no further comment to make concerning the races *Geothlypis trichas scirpicola* of southern California and *Geothlypis trichas chryseola* of southern Arizona and northern Sonora, save in minor detail. A re-examination of *scirpicola* fails to show any significant differences between the coastal and lower Colorado River valley colonies, a fact that is noteworthy, considering the differences usually shown by plastic species in these two areas. Specimens of yellowthroats from the Colorado River region are often deceptively pale, particularly those taken in spring and summer, but

such pallor is not evident in winter and can safely be attributed to intense sunlight or to an alkaline environment, or both. The range of *chryseola* is more extensive in southern Arizona than was previously known; it includes the Altar and Santa Cruz River valleys and also the upper Bavispe River valley in northeastern Sonora, from which specimens have been examined from the San Bernardino Ranch on the Mexican boundary (U. S. Nat. Mus.) and Pilares (Univ. Mich.). These slight range extensions were predictable, however, from previously known distribution.

In discussing yellowthroats from the extreme southwestern Tropical Zone (*op. cit.*, p. 298), of Sonora, little basis was found for positive conclusions. Most of the specimens were not distinguishable from *Geothlypis trichas modesta* from San Blas, Nayarit, and everything was included under that name, although with the observation that they were a variable lot. With recently collected specimens at hand this supposed variability is seen to be due to the fact that two distinct races were involved, one, *modesta*, which is confined to tidal marches, and one that differs materially in size, color, and proportions, which occurs on fresh water streams inland. The characters of this latter race, together with further comment, are given below.

Geothlypis trichas riparia new subspecies

Mayo Yellowthroat

Type.—Breeding adult male, no. 31945 Dickey Collection; Tesia, Mayo River, Sonora, Mexico, altitude 200 feet; collected June 22, 1937, by A. J. van Rossem and Robert Hannum.

Subspecific characters.—Ventral coloration of both sexes similar to that of *Geothlypis beldingi beldingi* of southern Lower California; dorsal coloration like that of *Geothlypis trichas scirpicola* of southern California, but pileum slightly grayer and frontal band and superciliary stripes in adult males slightly tinged with pale yellow; bill notably larger in size than in any of the previously described western races of *trichas* and about equal to that of *Geothlypis trichas melanops* of southcentral Mexico. Differs further from other western races of *trichas* in that the tail is equal to the wing instead of shorter; in this respect the proportions are as in *G. t. melanops*, *G. b. beldingi* and *G. b. goldmani*.

Range.—Riparian growth in the Mayo River valley and, in winter at least, the Yaqui River valley in southern Sonora.

Remarks.—The relationships of several yellowthroats are obscure, but short of a generic revision they cannot be further clarified. There seem to be various group combinations of size, color, and proportions but each one of these overlaps into others, so that no fixed limits can be set in any direction. The ranges of all members of the *trichas* complex are complementary and it is a perfectly simple matter to "prove" intergradation throughout the series by playing leap-frog without regard for intervening forms. For instance, it is not in the least a difficult task to prove *beldingi* a race of *trichas* by picking out almost any character and following it through *goldmani*, *melanops*, *riparia*, *chryseola*, *scirpicola*, etc. It is, indeed, rather surprising that such a course has not been advocated. The unfortunate Ipswich Sparrow is a comparable case in point. These remarks are not intended to be sharp-pointed; they are made to emphasize the need of a revision of the genus *Geothlypis* based on something other than undiluted systematics, and I suggest as a foundation for such a revision the study of Miller's recent treatment of the genus *Junco*.

To return to the local scene, it seems to be fairly well established that *modesta*, in Sonora at least, is strictly an inhabitant of coastal marshes. It is found in scrubby mangrove and other salt water associations from the Sinaloa boundary north to Kino and Tepopa bays, which latter localities mark the northern limit of mangroves and the narrow strip of Arid Tropical Zone along the coast. Incidentally, I have re-examined the two specimens of *modesta* formerly recorded (*op. cit.*, 298-299) from Lower California and reaffirm their identification. As has been mentioned previously, *sinuosa* of the San Francisco Bay region and *modesta* are much alike in color and are distinguishable chiefly by the slightly longer tail and larger bill of the latter. One is moved to speculate whether *modesta* and *sinuosa* are remnant colonies of a former, more general, salt marsh distribution, or whether similar environments have produced similar color characters.

Measurements of various races of *trichas* are to be found in the previous publication cited and need not be repeated here. Those of *riparia* are as follows: 5 adult males; wing, 55-56 mm.; tail, 55-56; exposed culmen, 12.0-12.6 (12.3): 3 adult females; wing, 50-53; tail, 50-54; exposed culmen, 12.0-12.5 (12.2).—A. J. VAN ROSSEM, *Dickey Collections, University of California, Los Angeles, August 20, 1941.*

Western Grasshopper Sparrow at Grand Canyon, Arizona.—On June 28, 1941, Ranger Mark Wisner picked up a dead Western Grasshopper Sparrow (*Ammodramus savannarum bimaculatus*) near the Kolb Studios situated at the edge of the south rim of the Grand Canyon, in Grand Canyon National Park. The nearest habitat at all suitable for a grasshopper sparrow is a small grassy

area on each side of the Santa Fe railroad tracks about 100 yards due south of the place where the bird was found. The bird was in good condition, very little decomposed, and not bloody. However, before the specimen could be skinned by the writer decomposition had set in and made the cause of death, as well as the sex, indeterminable. Possibly a car struck the bird as it crossed a paved road to reach the spot where it was found. The head showed some signs of concussion.

Swarth (Pac. Coast Avif. No. 10, 1914:53) reported the Western Grasshopper Sparrow only from western and southern Arizona. According to Mr. Allan Phillips of the Museum of Northern Arizona, recent investigation has shown this species to be a common transient and winter resident in southeastern Arizona. It is rare farther west in the state, and previous to this record, according to Phillips, no valid report of the bird had been made from, or north of, the Mogollon Plateau; the plateau is over 130 miles southeast of the Grand Canyon. The Grasshopper Sparrow is known to breed locally in a few places in southeastern Arizona.

The identification of the specimen found at Grand Canyon, which is now number B-472 in the collection of the Grand Canyon National Park, was verified by Dr. Alden H. Miller of the Museum of Vertebrate Zoology.—JOHN R. ARNOLD, *Stockton Junior College, Stockton, California, August 20, 1941.*

Wilson Snipe Perches on Telephone Pole.—On July 2, 1941, the authors were driving along a highway about 5½ miles south of Alturas, Modoc County, California, when an adult Wilson Snipe (*Capella delicata*) was noted sitting on top of a telephone pole about 15 feet from the ground. This seemed so unusual that we felt it advisable to recheck our identification of the bird; consequently, after passing a few hundred yards, we stopped and backed the car to a point even with the pole. After a few moments the bird left with characteristic explosive suddenness, uttering its familiar call, and alighted near by in a marsh.—CLARENCE COTTAM and CECIL S. WILLIAMS, *Fish and Wildlife Service, Washington, D.C., August 28, 1941.*

A Nighthawk Migration on an Arizona Desert.—When returning by automobile to Grand Canyon, Arizona, on July 29, 1941, Mrs. Bryant and I were astonished at the large number of migrating Nighthawks (*Chordeiles minor*) to be seen in food-getting flight over the desert. After noting twenty or more we decided to take a census. The following results were obtained between 7:30 p.m. and 7:55 p.m., sunset included, on a stretch of the Grand Canyon approach road about 35 miles south of Grand Canyon. The country is covered with sagebrush, with occasional patches of juniper and piñon pine. Mrs. Bryant watched on one side and I on the other, while driving. All birds counted were within 200 yards of the highway so that the strip used in the census was not more than 400 yards wide. We doubt whether the birds were any more abundant near the road than on the open desert and believe this count is a reliable sampling of abundance. The car traveled at 50 miles per hour. Probably many birds were missed in the course of the last few miles because of poor visibility with darkness fast approaching.

Mile	Nighthawks	Mile	Nighthawks
1st	5	10th	2
2nd	5	11th	2
3rd	8	12th	1
4th	6	13th	3
5th	3	14th	1
6th	4	15th	2
7th	3	16th	4
8th	2	17th	0
9th	0	18th	0

This made a total of fifty-one nighthawks, seen in a narrow belt over eighteen miles of desert, or an average of nearly three per mile, from a speeding car. And, of course, there were more birds than the eye could catch. The lack of birds in the last two miles may be attributed to the darkness.—H. C. BRYANT, *Grand Canyon, Arizona, September 6, 1941.*

European Starling in Nevada.—Because of the interest ornithologists have had in the movement and distribution of the European Starling (*Sturnus vulgaris*) and also because of the unusual economic significance of this bird, it seems appropriate to record a field observation of this species at Las Vegas, Nevada. The following is quoted from a letter from Dr. M. M. Ellis of the Fish and Wildlife Service:

"On August 12, 1938, Dr. B. A. Westfall . . . and I saw three adult Starlings in the trees in front of the post office at Las Vegas, Nevada. This was about 9 o'clock in the morning. Dr. Westfall is a trained ornithologist having had considerable experience in that field and I am well enough informed on the common birds to know Starlings without a doubt. We were both surprised to see these birds so far west and followed them as they flew from bush to tree in the vicinity of the U. S. Post Office. Our observations lasted over 15 or 20 minutes during which time we were very close to the three birds. Business matters took us on but we were so impressed with our find that we discussed it several times during the day and the next morning looked for the birds again. We did not see them. As you know large trucks come through from the East and Las Vegas is a base point for considerable trucking. We have nothing to offer beyond that suggestion concerning the arrival of these birds in Las Vegas. Both Dr. Westfall and I feel absolutely certain of our identification."—CLARENCE COTTAM, *Fish and Wildlife Service, Washington, D.C., September 8, 1941.*

Nesting of Buffle-head Duck at Lake Almanor, California.—While motoring on Lake Almanor, Plumas County, on May 19, 1940, I passed through some standing dead timber on the south side of the lake. I was surprised to flush a female Buffle-head (*Charitonetta albeola*) from a hole 25 feet up in a dead tree. Either the noise of the motor or the boat brushing against the tree scared her out. The duck flew up the lake a considerable distance and settled on the water, giving opportunity to identify it with the aid of field glasses. On May 20, I returned with a ladder. The female was in the vicinity but she did not allow me to approach closely. The nest contained six partly incubated eggs.—HOWARD P. DAVIS, *Alhambra, California, January 27, 1941.*

Two New Records for Nevada.—Examples of two species of birds heretofore unknown from the state of Nevada recently have been taken in the vicinity of Fallon:

Crocethia alba. Sanderling. A lone individual was seen and obtained (no. 81635, Mus. Vert. Zool.) on May 10, 1941, at the south end of Soda Lake, Churchill County.

Seiurus aurocapillus. Oven-bird. One was obtained (no. 83232, Mus. Vert. Zool.) on June 12, 1941, four miles west of Fallon, Churchill County. This bird was found by Mr. W. H. Alcorn near the stock corral on his ranch. It appeared to have been dead for about two days; we were unable to determine what had killed it.—J. R. ALCORN, *Fallon, Nevada, July 18, 1941.*

Summer Records from the Bodega Bay Region, California.—Ornithological observations made in the period from May 20 to June 27, 1941, in the vicinity of Bodega Bay on the central California coast, include a number of noteworthy records of summer occurrence. The field work centered about Dillon Beach, Marin County, and included the lower end of Bodega Bay, the northern part and mouth of Tomales Bay, and Tomales Point. In evaluating these records, I have had access to references on the birds of California assembled by the late Dr. Joseph Grinnell.

Gavia stellata. Red-throated Loon. This winter visitant usually leaves the coast of central California by early May. One adult was seen on June 13 on protected waters near the mouth of Tomales Bay. Two more individuals were noted on June 21 at the same location. Moffitt's record (Condor, 40, 1938:261) from Marin County of an individual taken May 22, 1921, is apparently the latest record heretofore.

Branta nigricans. Black Brant. Brant usually stay through April. A small flock of approximately forty individuals remained near the mouth of Tomales Bay until May 30. One or two individuals were seen at the same place on June 10, 25, and 26.

Numenius americanus. Long-billed Curlew. Mid-summer records of this curlew, which is predominantly a fall transient along the coast, are apparently few. A flock of ten was seen on June 26 on mud flats near Tom Point on Tomales Bay. Grinnell and Wythe (Pac. Coast Avif. No. 18, 1927:71) mention July 6 as an early date for the San Francisco Bay region.

Ereunetes mauri. Western Sandpiper. Summer "stragglers" have apparently been recorded on a a number of occasions along the central California coast. But it seems worth while to record a sizable flock of about seventy individuals which appeared on the mud flats near the mouth of Tomales Bay on June 26. Prior to this date no limicolines other than a few isolated individuals were noted in the region, but on the 26th, besides the present species, the curlews recorded above, a flock of seven willets (*Catoptrophorus semipalmatus*), and several unidentified sandpipers of different species appeared.

Limosa fedoa. Marbled Godwit. Approximately ten godwits were seen scattered over mud flats of Bodega Lagoon, Sonoma County, on June 12. "Stragglers" have been recorded along the central California coast through the summer season.

Larus philadelphia. Bonaparte Gull. A single immature gull of this species was seen on June 21

among Heermann Gulls at Dillon Beach. Grinnell and Wythe (*loc. cit.* :42) cite two June records for the San Francisco Bay region.

Larus heermanni. Heermann Gull. These birds usually arrive from their Mexican breeding grounds in June. It may be of interest to record a marked influx of this species into the Dillon Beach region on June 5, prior to which only a few individuals were present. Following that date, approximately 75 individuals remained on the beach that extends from the village of Dillon Beach southwestward to Sand Point (1¼ miles). Heermann Gulls were considerably more numerous than California Gulls (*Larus californicus*).

Calypte anna. Anna Hummingbird. This hummer reaches the northwestern limits of its breeding range in counties bordering San Francisco Bay; to the north of Golden Gate the species is normally confined to bay- and valley-drained slopes with oak woodland or open chaparral. It seems worth while to record a coastal occurrence near the tip of Tomales Point, where a male was seen on June 9. It was seen in a small grove of eucalyptus and cedar trees growing in an east-facing draw, the sides of which were otherwise covered with a low chaparral growth (*Lupinus*), grass, and patches of cow parsnip (*Heracleum lanatum*). This is my only record for the region.

Penthestes rufescens. Chestnut-backed Chickadee. The small grove of isolated trees in which the Anna Hummingbird was noted also harbored a pair of Chestnut-backed Chickadees, which was apparently established there. This is of interest in the matter of habitat relations of the species, since the remainder of Tomales Point is covered with chaparral and grass, the nearest coniferous growth being three-quarters of a mile to the south.—FRANK A. PITELKA, *Museum of Vertebrate Zoology, Berkeley, California, October 7, 1941*.

An Avifauna from Sub-Recent Deposits at Lower Klamath Lake, California.—A small collection of bird and mammal bones from the Lower Klamath Lake beds just south of the California-Oregon state line were sent for identification to Dr. Chester Stock of the California Institute of Technology by Dr. L. S. Cressman of the University of Oregon. Dr. Stock turned the bird collection over to the writer and suggested that a brief report should be prepared describing the avifauna. I am indebted to Dr. Cressman for information concerning the deposit, and to Drs. L. H. Miller and A. H. Miller for use of the comparative materials in their charge.

The avifauna consists almost entirely of aquatic species, most of which occur today in lakes and marshes along the Pacific coast. Remains of almost all of these birds have also been found in the Pleistocene deposits either at Fossil Lake, Rancho La Brea, or McKittrick.

The collection from Klamath Lake includes the following species of birds:

Colymbus auritus. Horned Grebe.
Aechmophorus occidentalis. Western Grebe.
Unidentified goose.
Anas platyrhynchos. Mallard.
Chaulelasmus streperus (?). Gadwall.
Dafila acuta. Pintail.
Querquedula, sp. Teal.
Spatula clypeata (?). Shoveller.
Nyroca valisineria. Canvas-back.
Clangula hyemalis. Old-squaw.
Mergus merganser. American Merganser.
Unidentified ducks.
Buteo, sp. Hawk.
Fulica americana. American Coot.
Larus, sp. Gull.
Asio, sp. Owl.

Perhaps the most interesting find in the collection is a humerus assignable to *Clangula hyemalis*. This duck breeds on the Arctic coasts of both hemispheres, only rarely wintering as far south as California. Flocks of Old-squaws usually feed in the surf near the outer beaches or in bays, but may also be found inland on large rivers and lakes. In spite of its rarity in the region today, the species has been recorded in the fossil avifauna from Silver Lake, Oregon, where it was represented by two ulnae (Shufeldt, R. W., Jour. Acad. Nat. Sci. Phila., ser. 2, 9, 1892:406).

No fossil records of the American Merganser have been found in North America, although remains of the smaller Hooded and Red-breasted mergansers have been reported from Fossil Lake (Wetmore, A., Smithsonian Misc. Coll., 99, 1940:28-29). The coracoid referred to *Mergus merganser* is quite large, being equalled in length only by coracoids of the two largest skeletons of this species in the collections of the University of California. Since the American Merganser is today a fairly common bird on the streams and lakes in the Pacific states, it is not surprising to find remains of it in this assemblage. The other avian species present are also those which one might expect to find on the freshwater lakes in this region. The Mallard, Canvas-back, Pintail, and Coot are the types found to be most abundant.

Remains of every species of bird represented in the collection were found at a locality called The Narrows. Only a few bones of the more abundant forms came from Laird's Bay, a deposit considered by Cressman (Carnegie Inst. Wash. Year Book No. 39, 1939-40:300-306) to be the younger of the two. He believes that the crude bone artifacts associated with the bird and mammal remains from The

Narrows represent a stage toward the end of the last Pluvial or Pluvial-Glacial period, somewhat more than 7500 years ago. The horizon at Laird's Bay probably represents the beginning of the Little Pluvial, more than 4000 years ago. Associated mammalian remains in the collection include horses, camel, deer, elk, and large and small carnivores.

According to Cressman (*loc. cit.*), bones from The Narrows were weathered or dug out of blue-gray mounds representing the older layer of peat on the lake bed. Bones from Laird's Bay came from ash deposits or were picked up on the surface. There does not appear to be any difference in the state of preservation of the bird bones from Laird's Bay and The Narrows. Some of them have a dark blue-gray color like the Fossil Lake specimens, but, in general, they do not appear to be petrified to so great a degree. Most of the bones are fairly well preserved, but some are weathered and many are broken.

Since the bones from both localities include species which dive for food in open water as well as those that dabble in the mud, it seems probable that the environmental conditions at the two localities were somewhat similar at the time of deposition of the remains. The avifauna as a whole is representative of a marsh-bordered lake such as existed in the region before 1917, when part of the lake was drained.—Ida S. DeMay, *California Institute of Technology, Pasadena, California, October 10, 1941.*

NOTES AND NEWS

By the death on September 29, 1941, of Commander Henry E. Parmenter, the Cooper Ornithological Club lost one of its most active observers in the field. He and Mrs. Parmenter recorded observations for more than 1700 days during their residence in San Francisco, beginning in the fall of 1930. In this vicinity their attention was given to shore birds rather than to the smaller terrestrial species. The preceding period of ten years was spent at Santa Barbara, where field work was done at times with William L. Dawson and Ralph Hoffmann. After his appointment to the U. S. Naval Academy on October 1, 1880, Commander Permenter spent his entire life in the Naval Service. His last active service was as Assistant Commandant of the 12th Naval District during the World War. His interest in biology and especially in birds was aroused in his two periods of service on the U.S.S. Albatross, covering nearly four years.—J.M.L.

Award of the Brewster Memorial Medal for 1941 was made to the late Donald R. Dickey and to A. J. van Rossem for their excellent work on the birds of El Salvador. It is gratifying to see this well merited honor come to Pacific coast ornithologists and to members of the Cooper Ornithological Club.—A.H.M.

The index for this volume of The Condor was prepared by Miss Selma Werner, who thus again has rendered a great service to users of information published in the magazine.

MINUTES OF COOPER CLUB MEETINGS

SOUTHERN DIVISION

JULY.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum on Tuesday, July 24, 1941, with President Howard in the chair and about eighty members and guests present. The minutes of the June meeting of the Southern Division were read, approved and corrected.

President Howard introduced Mr. James B. Dixon and his son Howard, who presented a motion picture in color depicting the life history of the Red-bellied Hawk. They also showed Kodachrome slides of the nesting birds of the Mono Basin. The pictures were beautiful and instructive, and were enjoyed by all present.

Following the pictures, the meeting was opened for questions and observations. Dr. McCoy mentioned large numbers of Wilson Phalaropes seen by him in the Mono Basin in the fall in comparison with the smaller number of nesting birds in the spring.

Adjourned.—IRWIN D. NOKES, *Secretary*.

AUGUST.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum on Tuesday, August 26, 1941, with President Hildegarde Howard in the chair and about 78 members and guests present. The minutes of the July meeting of the Southern Division were approved as read.

The following applications for membership were read: Joost ter Pelkwyk, Kananlweg, Batavia, Java, Netherlands East Indies, proposed by Mrs. Margaret M. Nice; Dr. Arthur Trevenning Harris, 275 Broadway, Laguna Beach, California, and Mrs. Ruth Ebert, 413 Shore Drive, Monette, Washington, proposed by Dr. Hildegarde Howard.

George Willett made a motion, which was seconded by Howard Robertson, that the application of a certain candidate, whose name was not read, be referred for investigation by the Board of Governors. The motion was put to question and carried.

Mr. Willett read a resolution opposing the opening of the Organ Pipe Cactus National Monument in Arizona to prospecting and mining. A motion for the adoption of the resolution made by Dr. C. A. Warmer, seconded by C. O. Reis, was unanimously carried.

President Howard introduced the speaker of the evening, Dr. Arthur T. Harris, who presented three motion pictures in color. The first one depicted Herring and Ring-billed gulls and Caspian Terns in Wisconsin. The second was of the Marsh Hawk, Great Blue Heron, American and Least bitterns and Virginia, Sora and King rails in an Indiana swamp. The third picture was of the Red-headed Woodpecker and the Bluebird.

The meeting was then opened to discussion and observation.

Adjourned.—IRWIN D. NOKES, *Secretary*.

NORTHERN DIVISION

JULY.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, July 24, 1941, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with President E. Lowell Sumner, Jr., in the chair and 78 members and guests present. Minutes of the Northern Division for June were read, corrected and approved.

Mr. Sumner described the sea bird colony at Cape Lookout, Oregon. California Murres, Pigeon Guillemots and Western Gulls were abundant the last week in June. The state of Oregon has asked the Park Service to keep the area as a reserve comparable to Point Lobos. Mrs. Kelly reported that on the rocks at Requa, the murres were present in uncountable numbers in the first week in

June. Shorebirds were again to be seen in abundance at Alameda; on July 9, dowitchers numbered 250. Mrs. Kelly also called attention to the leaflet sent out by the National Audubon Society urging its members to write in an attempt to forestall any possible legislation that might remove protection from the Wood Duck. Floyd Durham told of the nesting of Sparrow Hawks at the letter "I" in the Richfield Tower at San Gorgonio Pass. Presence of the male at "C" prevented easy access to the nest.

As speaker of the evening, Mr. David G. Nichols gave an account of the birds of the Berkeley Aquatic Park, illustrated with some of the many pictures he has taken in his extensive studies of bird postures. Meteorological factors affect importantly the park population, which may be halved or doubled according to prevailing weather conditions. Another variable to be taken into account in any census work is the day and night rhythm of different species.

Adjourned.—FRANCIS CARTER, *Recording Secretary.*

AUGUST.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, August 28, 1941, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with Alden H. Miller presiding and 40 members and guests present. Minutes of the Northern Division for July were read and approved.

Mrs. Bracelin gave an early fall date for the return of Audubon Warblers as August 25 in Golden Gate Park. Mr. E. L. Sumner, Sr., observing on Cape Code with Ludlow Griscom on July 12, counted 20 Arctic Terns. Mr. Miller displayed an unwelcome "return" record, the large band from the condor, Herkimer, banded as a nestling two years ago.

Mr. Miller then introduced as speaker of the evening one of the runners of a recent ornithological marathon, Mr. Charles Sibley, whose subject was "16,000 Miles through the United States and Mexico, in Search of Birds and Birders." The real object of the "marathon," in which Sibley participated with Robert Storer and John Davis, was to see as many birds, visit as many museums, and meet as many people as possible. The itinerary led first across the continent. Following down the east coast and through Florida and Texas, they arrived in Mexico City. The distribution of many Mexican birds extends nearly to the United States, but the Sierra Madre of Mexico, where there are found such exotic species as the squirrel cuckoo and the green parоquet, tapers off just before the border. One of the most striking characters they met on the trip was W. W. Brown, whose diligent care in the preparation of specimens made him an esteemed collector for Thayer and Ridgway. A tray of representative study skins illustrated the account, and was examined with great interest after the meeting.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

SEPTEMBER.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, September 25, 1941, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with Vice-president Richard M. Bond presiding and 45 members and guests present. Minutes of the Northern Division were read, corrected and approved. Names proposed for membership were: (Mrs.) Kathryn K. Fletcher, 24 Roble Court, and (Mrs.) Leontine R. Watts, 52 Eucalyptus Road, both of Berkeley, by Amelia S. Allen; Miss Alice Victoria S. Johnson, 2834 Garber Street, Berkeley, by Prof. S. G. Morley; Thane Riney, Carmel, California, by Ned W. Stone; Richard W. Neil, 2135 Haste Street, Berkeley, by Alden H. Miller.

Dr. Miller reported on activities of the American Ornithologists' Union at its annual meeting, in Denver, Colorado, September 1-6.

Mrs. Grinnell brought the club's attention to a new book, "We Follow the Western Trail," by a member of the Cooper Club, Mrs. Ruth Wheeler, of Angwin, California.

Mr. Bond reported a 10 per cent return on bandings of Brown Pelicans on Anacapa Island, with extreme coastal returns from Colima, Mexico, and the Del Norte-Humboldt County line, California. Mrs. Allen displayed a Bush-tit's nest without an entrance opening and also a vireo's nest sent to her from New England. She added recent observations on masses of shearwaters at Point Reyes and on land bird migration at Inverness. Mr. Bond reported a pairing of California Quail and Chuckar Partridge during the past season, discovered by Mr. Ray Alcorn near Fallon, Nevada.

The speaker of the evening, Mr. Frank Watson, gave an interesting account of his experiences in observing migration in New Jersey. He discussed the general sequence of migratory movements during the spring and fall seasons and described the phenomenon of migration waves. Spring flights, in general, are to be correlated with periods of warm weather. During migration waves, night-flying migrants, especially warblers, may be heard chiefly from 8 to 11 p.m., and from 2 to 4 or 5 a.m. The lull in calls during the middle of the night is to be explained probably by the fact that the birds gain higher altitudes at that time.

Adjourned.—FRANK A. PITELKA, *Acting Secretary.*

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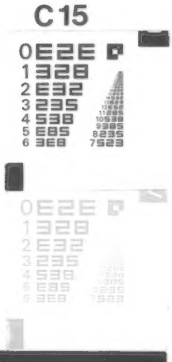
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